A Contextual Analysis of Cycling Environment Assessment Tools in a Cape Town Mobility Corridor

submitted in partial fulfilment of the requirements for the Master of City and Regional Planning degree of the University of Cape Town

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Abstract

Building on recent research on barriers to cycling mobility in low-income South African contexts, this study explored the role of the built environment as a determinant of cycling practices along a mobility corridor in Cape Town, South Africa. The communities surveyed reflect the demographic and income disparities of the city, and their attitudes to cycling and the cycling environment both corroborate existing findings and pose new research questions. In particular, respondents of all income levels showed that they distorted their own journeys by bicycle to avoid areas perceived to have a high risk of criminal activity, even where this meant using routes perceived to present a high risk of physical injury. A second finding was that all road users engage in informal road behaviour, including motorists, and that this is an integral aspect of the study area's mobility culture. The methods used in this study were a series of interviews with three community bicycle-shop owners, supported by focus groups held in each community, and accompanied by a mapping exercise. Fieldwork took the form of accompaniment of youth cycling initiatives and observation of commuting practices by the author. The data obtained in fieldwork were then used to evaluate a selection of cycling environment assessment tools from the USA, UK and Australia, and a pedestrian environment assessment tool from South Africa, in order to evaluate their contextual appropriateness for the local determinants of cycling. The study concludes with recommendations towards a South African cycling environment assessment tool that would capacitate local government and civil society to deliver improvements to the cycling environment and capitalise on existing pro-cycling policies.

Keywords

bicycle level of service, cycling environment assessment tool, south africa, global south, transport justice.

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Terms and Acronyms

Bicycle Level of Service (BLoS): this refers to cyclists' "perceived safety and comfort with respect to motor vehicle traffic while travelling in a roadway corridor" (AASHTO, 2012).

BLoS Tool: a Bicycling Level of Service Tool - an assessment framework, mechanism or tool for evaluating the Bicycle Level of Service of a defined route, area or corridor.

Cycling: throughout this study, commuter bicycling, or cycling undertaken for transport as opposed to recreation, will be referred to as 'cycling', while other bicycle-related activities will be described in full, such as sport or recreational cycling.

Cycling Environment: this term refers to the entirety of the experience of cyclists as they move through urban or rural areas, including the built environment, interactions with other persons and vehicles, and the natural world.

Cycling Environment Assessment Tool (CEAT): similar to a BLoS tool, but based on an assessment approach other than BLoS.

Pedestrian: throughout this study, 'pedestrian' means "any person on foot or using a mobility aid or means of conveyance propelled by human power, other than by cycle — for example, a wheelchair, rollerblades, skateboard, mobility scooter, and so on" (Bonham & Johnson, 2015:252).

Sprawl: Under sprawl conditions, the value of being at a given location falls as more sites become mono-functional, while the viability of public motorised transport, and non-motorised transport, is reduced as population densities fall and trip destinations become more dispersed (UN-Habitat, 2013).

Foreword

Firstly, I would like to thank Jimmy Esterhuizen, for his time, for his help, and for sharing some of his profound knowledge and experience with me. I would also like to thank Zwai, Morgan and the staff of the Masi Bike Shop for their help. Tim, Megan and everyone at BEN - thank you for giving of your time and energy to help me, but mainly, thank you for creating a supply of good, affordable, high-quality bikes: it was affirming and energising to see your work in action, every day, across an entire valley. Especial thanks also to Teuns, Gregory, Elias and everyone in NMT at the CoCT - you have been generous, open and frank about your own work and your own aspirations for cycling in our city. Thanks for Noluthando for facilitating and Thulani for translation.

I would like to dedicate this effort to my mother, Isabel, for continuous and lifelong love, support and encouragement. Thanks to my sister, Alessandré, for your patience and love. To my comrades - in order of appearance - Emma, Jai, Karen and Pete, Ty, Scott, Rashiq and Liam, you got me here. To Rashiq, again, for simply believing, and making others believe, that I was an urbanist until it became approximately true. To Gail, for friendship, patience, and an apprenticeship in bike thinking. To Adam, for scaffolding and comradeship. And to Nancy, for all the support through a rather dynamic semester. Lastly, much of this degree was achieved with the support of R, to whom I owe a debt of gratitude.

Figure 1: (cover image): Roadworks on Kommetjie Road (Source: Author)

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Chapter 1. Evaluating Bicycle Level of Service Tools: An Introduction

1.1 Introduction

This dissertation grew out of my lived experience as a cyclist in Cape Town, South Africa, at the end of the city's first decade of significant and sustained investment in cycling; it was completed a few months before the planned release of the metro's Cycling Strategy - a first in this country. At present, cycling is receiving serious attention from South African policymakers and transport planners, in an attempt to understand and enable it on its own terms, rather than as an adjunct of driving or walking. Yet cycling is too important to be left only to professional planners, given the persistence of top-down infrastructure planning habits in South Africa (von Schnitzler, 2013), as well as their mixed record in recent planning for cycling (Jennings, 2015). One way of equipping all those interested in cycling with the means to advocate for change in their own communities, would be the creation of a stand-alone assessment tool for the cycling environment of South African cities, towns and villages. Such a tool might constitute a common language between professionals and laypersons, and allow for measurement of change over time. Importantly, quantification would also allow cycling discussions to move beyond the anecdotal, and better equip all stakeholders to discuss this mode of transport in greater technical detail. This dissertation aims to advance this aim by surveying the efforts taken by other scholars and local governments to develop cycling environment assessment tools (CEATs), and comparing these to local determinants of cycling, as experienced by focus group participants along the Kommetjie Road corridor in Cape Town's Far South. What has emerged from their accounts is a complex picture of how cyclists adapt to the automobilised landscape of Kommetjie Road, and the very great extent to which all classes of road user participate in reinscribing their own road culture onto the professionally planned streetscape. This study will consider local determinants of cycling in both technical and non-technical terms, and concludes with some recommendations about how a contextually appropriate South African CEAT might incorporate both these aspects.

1.2 Overview to the Study

More than two decades after the end of Apartheid, South Africa's mobility landscape remains a site of intense contestation (Pirie 2013, 1993). Legacy modes such as commuter rail and municipal bus services are in recovery from decades of falling investment, service levels and modal share (von Schnitzler, 2013). Paratransit, in the form of the minibus taxi industry, established itself in response to a changing transport landscape in the 1980s to become the dominant form of public transport countrywide, as well as one of the few black-owned economic sectors (Wilkinson, 2010). This decade has seen the advent of prestige public transport projects embodying a 'world-class' discourse, such as the Gautrain, and Cape Town's bus rapid transit (BRT) system (van der Westhuizen, 2007). These modes all compete for funding, mode share, and rights of way, sometimes violently (Asmal, 2015). Some metros envisage "in toto replacement of paratransit...with formalised BRT systems" (Ferro, Behrens & Wilkinson, 2012:121), presaging further conflict between the state and the politically powerful minibus taxi sector. The emergence in this millennium of non-motorised transport (NMT[1]) as a mode attracting dedicated funding and expertise (Jennings, 2015) has thus taken place against a dynamic and competitive backdrop.

In South Africa, cycling has been identified as a transport mode that is able to offer reliable, low-cost, short-to-medium distance mobility to commuters since at least 1987 (CSIR, 2003), with major updates to cycling policy occurring at regular intervals at national, provincial and local government level. However, at present the country does not possess a standard tool for the assessment of the cycling environment. This is despite a direct call for such a tool in the Draft Policy for National Non-Motorised Transport of 2008 (National Department of Transport of South Africa, 2008:48). In many countries, particularly within the English-speaking world, (specifically the United Kingdom, the United States of America, Australia and New Zealand), CEATs have emerged in the last two decades as an approach to creating data that describes the relationship between cycling and the physical environment as metropolitan, suburban or corridor scales.

CEATs vary greatly in their degree of complexity, from simple online tools that are designed to be used by anyone, to complicated GIS-based tools designed for transport professionals. The same is true of their primary purpose, which varies from facilitating advocacy efforts to prioritising investment by the state. All of the CEATs considered in this study have one key element in common – they are tools for the analysis of the cyling environment, a term which here refers to both the surfaces on which cycling takes place (including mixed-traffic roads, dedicated cycling paths and shared spaces), as well as the immediate and wider physical context that influences cycling. A further point of difference between CEATs is in the criteria they include, and the weightings assigned to this. This difference reflects the lack of scholarly consensus on the physical correlates of increased cycling rates across fields such as public health, transport and urban planning studies (Fraser & Lock, 2011; Saelens, Sallis & Frank, 2003). CEATs are one tool among many that might be used to develop a comprehensive analysis of cycling within a given area. Within the field of transport planning, these tools may be complemented by a range of other data collection and analysis exercises, such as GIS-based data collection, cost-benefit, flow, safety, and bicycle travel demand analyses, as well as network planning exercises, inter alia (AASHTO, 2012). The adaptability of CEATs, and their focus on physical infrastructure, has seen them gain broad acceptance among activists and advocacy organisations, enabling non-specialists to produce spatial cycling data that is to some extent comparable to that used by transport professionals (Lowry et al, 2012). This aspect is also appreciated by local governments without ready access to the expertise of dedicated transport professionals specialised in cycling, which describes the majority of non-metropolitan local governments in South Africa (Jennings, Goldman & Petzer, 2016).

As will be discussed below, cycling is a mobility practice that depends on much more than transport infrastructure, narrowly construed. Indeed, 'planning for cycling', as with planning for walking, cannot be achieved through transport planning alone, but depends on the achievement of a cyclable and walkable urbanity (Black & Street, 2014). In practical terms, this includes considerations ranging from land-use planning to passive surveillance. The latter concepts bring 'planning for cycling' firmly into the realm of urban planning in its broadest sense (ibid). Cycling and walking are thus positioned at the confluence of two major developments in theory and practice: the mobilities turn in urban studies, and the urbanist turn in transport studies (Koglin & Rye, 2014; Lanzani & Longo, 2016). This study will explore the urban planning implications of a mobility practice that has hitherto been considered almost exclusively in transport planning terms in the planning history of the study area (Far South Community Forum [FSCF], 2015). In order to understand the determinants of cycling in South Africa, a study was conducted among cyclists residing in the Kommetjie Road corridor in Cape Town, South Africa (the case study area for this research). This study aimed to establish the full range of spatial factors that influence cycling trips originating or ending in the study area. The results of this qualitative study were then compared to a composite list of CEAT criteria in Table 2-3. Discrepancies between the stated determinants of local cycling, and those set out in the CEATs surveyed from abroad, were used to draw up a list of recommendations that should be considered in the development of a contextually appropriate South African Bicycle LoS Tool.

1.3 Identifying the Problem under Study

The lack of a CEAT adapted to the South African context represents a missed opportunity to enable stakeholders such as activists, community organisations, educational facilities, and local and provincial government to produce spatial cycling data that can serve as a means of comparison between localities. This would serve as a guide to for future investment and current maintenance strategies, and as a potential point of departure for dialogue around issues of broad accessibility and inclusion. Existing CEATs surveyed in this study were developed to describe conditions in developed countries (with one exception from India), and may thus not be appropriate for describing local conditions.

1 In South African transport policy discourse, NMT is the common term for walking, cycling and other human-powered modes

1.4 Establishing the Aims of the Study

Any tool intended for spatial analysis of South Africa's built environments must reckon with their numerous unique qualities, and with the historical forces that have shaped, and continue to shape them. Among the many differences between the South African context and the high-income contexts of the CEATs surveyed, poverty, apartheid spatiality, and crime and violence have been shown to exert a marked influence on the mobility practices of people in South Africa (Ribbens, 2003; Ribbens, Everitt & Noah, 2008). While the academic literature on cycling in South Africa remains limited, it is likely that cycling is impacted on by the same forces operating on mobility practices in general. As such, the wholesale adoption of Bicycle LoS Tools which are developed for very different spatial contexts is likely to produce results which fail to capture the full range of determinants that operate in the South African context. This study therefore aims to provide a set of recommendations guiding the development of a prospective South African CEAT that is adapted to local conditions.

1.5 Establishing the Main Research Questions and Research Methods

The main research questions for this study ask:

- To what extent can CEATs from outside South Africa capture the determinants of cycling within the study area, with reference to both the kinds of criteria included and the methods or units used to measure these?
- Do such CEATs exclude factors that have proven to be significant within the study area? If so, how might these be captured in a prospective South African CEAT?

In order to answer the main research questions (as well as the subsidiary research questions established in Chapter 2), a number of research methods and techniques are used. These include semi-structured interviews, focus groups and mapping exercises. Each of these methods and techniques are discussed in greater detail in 3.

1.6 Establishing the Research Methods and Approach

This study was divided into four phases. The first was a literature review on the research topic, including in particular a survey of existing CEATs. The second phase involved a spatial analysis of the study area, which included a desktop study and first-hand reconnaissance of the area by bicycle, as well as non-participant observation. The third phase took the form of semi-structured interviews and focus groups held in each of three communities within the study area. Semi-structured interviews were included to establish a general profile of cycling practice within the area, and communicate the aims of the study to community research partners, who subsequently assisted in recruiting focus group participants (Longhurst, 2010). Focus groups were used to facilitate the development of spontaneous discussions between research participants themselves – thereby decentering the role of the researcher and helping to temper power imbalances that are inherent to planning and research (ibid). A more detailed methodology is presented in Chapter 3.

1.7 Structure of the Dissertation

Chapter 1 of this dissertation presents a background to the study to the study, as well as the rationale, research questions, and research approach. Chapter 2 presents a review of the relevant literature, including a survey of existing CEATs and the context and manner in which they have been used. Chapter 3 presents the research methodology employed in the study. Chapter 4 presents and analyses research findings from the qualitative study of cyclists within the case study area, as well as a synthesis of the criteria considered by the CEATs surveyed. Chapter 5 analyses the data with the theoretical tools established in Chapter 3. Conclusions to the research are also discussed here, as well as recommendations for further study.

"The road itself, I can't say that there is a problem. The problem is the people who are using it."
- 'George', Masiphumelele 1 Focus Group

Figure 2: A cyclist makes his way down the painted median of Kommetjie Road

Chapter 2. Establishing a Conceptual Framework through a Review of the Relevant Literature

2.1 Introduction

Although cycling predates the motor vehicle as a form of mass transport, it has only recently received sustained attention at policy level and within the academy in South Africa. This chapter thus seeks to situate cycling in the Kommetjie Road corridor within the broader history of mobility in South Africa. Doing so allows for a comparison between the pro-cycling arguments encountered in a review of policy, and the constraints on non-motorised transport that operate on the ground. In a country in which mobility has long been instrumentalised in service of state control, choices about movement have many non-technical meanings for which the 'mobilities turn' in social science, and the field of transport sociology in particular, offer powerful means of analysis. The first part of this chapter therefore considers the rise of automobility as a socio-technical regime, and how this shift combined with Apartheid ideology to construct the contemporary South African road.

An automobilities perspective is then applied to the problem of assessing the quality and performance of the cycling environment. Since 1987, various responses to this challenge have been forthcoming, in the form of Cycling Environment Assessment Tools (CEATs). A selection of CEATs is surveyed for the purposes of compiling a composite list of their criteria, to be examined against findings from the Kommetjie Road corridor in Chapter 4. While the criteria used by these tools, such as traffic volume or lane width, shows a high degree of overlap, the more recent tools reflect a growing emphasis on network-level effects and conditions.

2.2 Policy Review

This section considers the policy context of the study area, starting at the international scale and working down.

2.2.1 Transport Policy at the global level

At the global scale, bodies responsible for transport have long advocated a shift towards more sustainable, equitable and safer mobility systems. However, the rapid increase in wealth in the global South in this century has brought new urgency to the matter, as urbanisation and motorisation have advanced in tandem across many cities of the developing world (Wells & Beynon, 2011).

Two recent publications comprehensively and specifically address mobility at the global scale. The *UN Habitat Global Report on Human Settlements 2013* (the 'GRHS'), subtitled *Planning and Design for Sustainable Urban Mobility*, considers the relationship between mobility and urbanism from a global perspective, while the United Nations Environmental Programme's *Global Outlook on Walking and Cycling* (UN Environment, 2016) focuses on NMT.

One of the principal concerns highlighted in the GRHS 2013 is the 'transport bias' of mobility., This refers to the equation of 'mobility' with 'transport', (that is, the provision of the means to be mobile) rather than the positioning of 'mobility' as one of several means of achieving 'accessibility' (that is, the ability of individuals to meet their needs, for which physical travel is merely a derived demand) (UN-Habitat, 2013). By this definition, 'accessibility' may also be promoted by reducing the need for transport (for example, through greater proximity) and optimising the value of being at a given destination (for example, through land use planning). In summary, the report states that:

> Mobility is not only a matter of developing transport infrastructure and services, but also of overcoming the social, economic, political and physical constraints to movement.
>
> (UN-Habitat, 2013:3)

This report thus highlights a key paradigm in current thinking about transport planning, which insists on transport (and, *a fortiori*, motorised transport) as one of many, rather than the sole, means of achieving accessibility (ibid). A second major theme in the GRHS is the link between transport bias and motorisation (ibid):

> the transport bias of urban mobility is demonstrated by the dominance of motorisation, and particularly [by] private motor vehicles as the preferred means of mobility.
>
> (UN Habitat, 2013:5)

The report explains that transport bias and motorisation are interlinked in self-reinforcing ways through a hierarchical and mono-functional land-use regime known as 'sprawl'. This mobility regime, in which accessibility becomes increasingly contingent on access to private motorised transport, is increasingly prevalent in the developing world (ibid; Wells & Beynon, 2011).

UNEP's Global Outlook on Walking and Cycling offers an analysis of Cape Town's NMT policy in comparison with South Africa's national policies and those of other cities and countries of the Global South (UN Environment, 2016). It noted in particular that South Africa was relatively unique among Southern nations in imposing a high policy and planning commitment on local government, combined with a much weaker commitment to implementation, and a virtual absence of formal monitoring and evalution (ibid:. This is significant for CEATs because they may enable civil society to fill this gap.

2.2.2 Transport Policy in South Africa

In a survey of public transport policy in South Africa since 1994, Walters (2013) describes the key shifts in policy and practice. The first of these was the introduction of competition in road-based public transport. The White Paper on National Transport Policy of 1996 "established the principle of competitive tendering for subsidised services, and promoted the principle of competition for the route in contrast to on the route" (ibid:35). A legacy of this shift was the contractualisation of subsidised operators and the introduction of tendering for public transport services (ibid). However, this shift

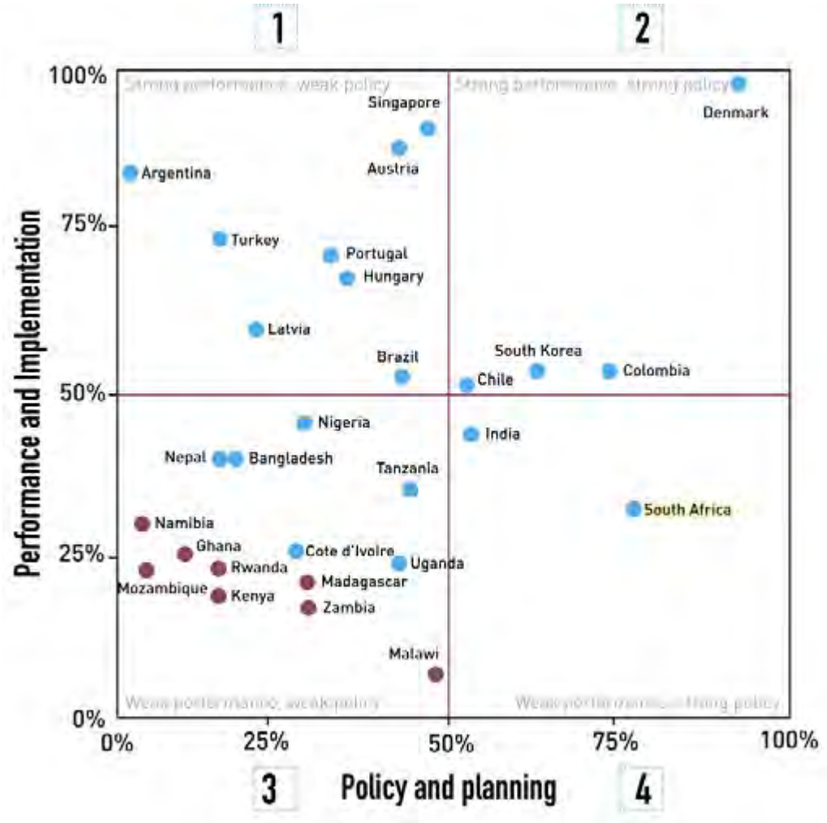

Figure 3: The NMT Index, a measure of national scores in policy and planning versus performance and implementation.

South Africa's position in the 4th quadarant indicates that NMT planning in this country presents a somewhat unique combination of very strong policy and planning scores (second only to Denmark, a wealthy society with an established cycling expertise export industry), and relatively low scores on performance and implementation. In this image, blue dots represent a positive response to the question, 'Does your city have a formal public transport implemenetation programme?'; red dots equal a negative response.

has aroused the longstanding opposition of organised labour and its political allies, which constitutes a major constraint on the progress of competitive tendering (ibid). Second, was the recognition of roadways as valuable and finite public space, to be distributed between transport modes on the basis of efficiency. This was given effect by the Moving South Africa Strategy of 1998, which recommended the establishment of a corridor focus, the densification of such corridors, and the principle of intermodal transfers along them (ibid). Third, was the delineation of transport planning roles between spheres of government. The National Land Transport Transition Act of 2000 and its successor, the National Land Transport Act of 2009, defined the transport functions of each level of government; established the principle of metropolitan transport authorities and (in the 2009 Act) the principle that transport should be devolved to the lowest effective level of government; and made provision for integrated public transport planning to coordinate the activities of these levels (ibid). Fourth, was the introduction of the current integrated rapid public transport network (IRPTN) paradigm. As set out in the National Department of Transport's Public Transport Strategy and Action Plan (2010), the IRPTN vision introduced a clear delineation between trunk (rail and bus rapid transit), and feeder (all other modes) modal services. The plan proposed a fully integrated single-fare network that would reach to within 1km of 85% of residents in all South African metros by 2020 (Walters, 2013).

Significantly, the positioning of NMT as an IRPTN feeder mode represented its first practical inclusion as a key component of an overarching transport vision. Following this, the substantial NMT investment made ahead of the 2010 FIFA World Cup cemented this newfound status. This was in contrast to previous policy iterations, which had seen NMT gains in priority on paper accompanied by little change in state spending or conditions on the ground, which supports the UNEP finding above that implementation has been a particular shortfall in this country. However, while the National Land Transport Transition Act mentioned above devolved the bus rapid transit (BRT) system to metro level, the other feeder mode, rail, remained at national level, with profound consequences for NMT as a feeder mode in metros.

Table 2-2: Cycling Route Network Planning principles, as per the South African NMT Guidelines (2014), adapted from Vanderschuren et al. (2014:27-30)

Step	Process
1	**Inventory**
This step involves information-gathering on potential and current cyclists and their trip motives, the cycling demand and determinants in a given area, the cycling environment (hazards and constraints), and potential routes.	
2	**Determining Needs of Cyclists**
The Guidelines recognised three main types of cyclist in South Africa: Neighbourhood/Scholar, Commuter and Recreational. This step involves information-gathering from these cycling constituencies.	
3	**Mapping Existing Facilities, Routes, Bicycle-Related Accidents and Bicycle Volumes**
This step involves mapping existing facilities, conducting surveys of bicycle flows (usually during morning and afternoon peaks), spatializing existing data (i.e., mapping existing data on collisions, input from cyclists, etc.). Also included in this step are explicit instructions to consult with a representative sample of cyclists.	
4	**Mapping Main Infrastructure Barriers and Identifying Missing Connections**
Barriers that obstruct travel, such as highways, wetlands and "insecure areas" should be identified and added to the base map.	
5	**Assessing and Understanding Potential Demand**
Potential or latent demand describes potential new bicycle trips which are currently suppressed. This step therefore involves information-gathering from both cyclists and non-cyclists on "cycling constraints (and their order)".	
6	**Prioritising Bicycle Network Structure including Route Components**
This step involves using qualitative or quantitative methods to "define and establish the priorities for a bicycle network" that is safe, coherent, direct, comfortable and attractive.	
7	**Developing Sketch Plan Bicycle Network Structure**
In this step, the information gathered in the preceding six is collated and input into a transport model or strategic outline. The end deliverable is a network plan.	

In 2014, NMT policy in South Africa received a major boost with the publication of the National Department of Transport's NMT Facility Guidelines (Vanderschuren et al., 2014), which offer the most comprehensive coverage of NMT issues in a national government text to date. The Guidelines consider bicycle planning, NMT road design, end of trip facilities, capacity (bicycle congestion), NMT pavement design, maintenance, and operations. While this policy only briefly mentions Level of Service concepts, it does set out basic recommendations for cycling network design in South Africa in a seven-step process, listed in Table 2-2 (Vanderschuren et al., 2014:27). This process includes two steps relevant to CEATs. In Step 1, the 'hazards and constraints' of the 'cycling environment' are inventoried, while in Step 3, existing facilities are mapped. The Guidelines also discuss 'condition assessments', recommending that "condition indices" for each NMT asset type (such as footpaths or cycle paths), as well as "consolidated and composite indices", be determined. The Condition Index (CI) is a measure of condition ratings (the physical condition of the NMT facility), functional ratings (the 'service level' of the facility, or its ability to handle flows of NMT users), and ambiance ratings (attractiveness and safety). The CI is a qualitative and subjective measure based on concepts such as 'reasonable' service levels or distinctions between 'generally' and 'very unattractive' facilities (Vanderschuren et al., 2014). It is expressed as follows (ibid:154):

$$\text{Composite Index} = \text{Condition Index}^{1} \times \text{Functional Rating}^{2} \times \text{Ambiance Rating}^{3}$$

The CI arguably constitutes a basic form of CEAT, although it is, again, internal; as with the deliverables of Steps 1 and 3 above, no standard methodology is provided for its application. Although existing cyclists are mentioned in the Guidelines as a source of knowledge to be consulted in Step 3, no mention is made of how to effectively include such groups in planning, or how such groups might hold planners to account where delivery does not meet expectations. The NMT Facility Guidelines thus represent a major advance in bringing NMT assets into the fold of mainstream transport planning, and they provide some guidance on cycling planning. However, they apply only to NMT facilities, not mixed-traffic roadways, and so are of limited use in evaluating the great majority of South Africa's built environment, in which dedicated cycling infrastructure is absent.

2.2.3 NMT Policy in Cape Town

At the time of writing, the City of Cape Town is poised to become the first in South Africa to adopt a detailed, costed and funded Cycling Strategy, having created an NMT Policy in 2005 and a Bicycle Master Plan in 2011 (Kok, 2014, 2016). Irlam (2016), Baufeldt (2016), Jennings (2015), and Jennings, Goldman & Petzer (2016) offer the most recent survey of the fast-developing field of NMT policy in South Africa, with particular reference to commuter cycling. Documents from the Western Cape Provincial government have been omitted, due to their very high degree of concurrence (as regards commuter cycling) with those of the City, which is the Province's only metro. The City's own published documents relevant to commuter cycling include:

- Transit-Oriented Development Strategic Framework (2016)
- Comprehensive Integrated Transport Plan 2013-2018 (2015)
- Road Safety Strategy (2013)
- Bicycle Master Plan (2011)
- NMT Policy and Strategy (2005)

City documents relating specifically to commuter cycling within the study area include:

- Far South Strategic Environmental Assessment Report (2015)
- Southern District Plan (2011)

At the time of writing, a major transport study of was underway, which included the study area (Herron, 2016). As with the city's Cycling Strategy, this will be published after completion of this

1 Rated from 0, 'very poor', to 100, 'very good'.
2 Rated from 1, 'very good', to 5, 'very poor'.
3 Rated from 1, 'very attractive', to 5, 'very unattractive'.

dissertation, however, in both cases, the author was able to correspond with officials responsible for these projects and gain an understanding of their basic scope. These documents will be discussed below in an integrated way, as they relate to particular aspects of commuter cycling in Cape Town, and incorporating critique from various sources outside of the City departments.

Overall, most critiques of cycling policy in Cape Town acknowledge that the regulatory and legislative framework is primarily supportive of cycling and relatively cohesive in addressing all aspects of cycling (Irlam, 2016). In particular, policies tend to recognise the importance of cycling in offering a lower-cost means of independent mobility than even public transport, which distinguishes the City's policies from the bulk of policies generated in the developed world, where cost savings versus public transport are less prominent as a motivator (Jennings, 2015). These sources also uniformly characterise the delivery of these policies as insufficient. Irlam posits that authorities may not be fully convinced that NMT offers "a genuine solution for providing low-cost mobility", and also cites the lack of a "critical mass of NMT projects, experts and technical specialists" (2016:13). This is reflected in cycling statistics, where Jennings (2015) found that, a decade after the publication of the city's first NMT Strategy (2005), there was no evidence that modal share for cycling had increased, reinforcing the UNEP finding that monitoring and evaluation was a particular weakness in South African NMT planning. Jennings concluded that, whether this was due to a lack of growth in cycling or a lack of interest in adequately measuring cycling volumes, this problem reflected the lack of follow-through where the City's NMT commitments are concerned.

In Cape Town, which positions itself officially as a cycling city, (Jennings, Goldman & Petzer, 2016), spending on cycling is high and rising: while the National NMT Guidelines recommend annual NMT expenditure of R10 per resident, Cape Town exceeded this figure, spending R530 million on NMT between 2005 and 2015, for a population of 4 million (Hendricks, 2012), or about R13.25 per person per year. This figure continues to rise sharply (Kok, 2016). While this investment has produced physical outputs – including showpiece infrastructure extensively used in marketing the city – it has also been criticised for a lack of connectivity and cohesion, a lack of legibility and signage, a lack of consistency and a recognisable design language, and a lack of awareness of context (meaning that a number of Class 1 cycling facilities pass through areas that are deserted outside of working hours, making them hotspots for crime) (Ribbens, Everitt & Noah, 2008; Boulle, 2013; Jennings, 2015, 2016; Irlam, 2016; Jennings, Goldman & Petzer, 2016).

One particular critique with relevance for cycling in Cape Town is the finding that the City restricts its spending to 'outputs', rather than 'outcomes', meaning that its own texts target physical deliverables such as 'kilometres of cycling infrastructure', rather than adopting specific and measurable targets for behavioural change or modal shift (Jennings, Goldman & Petzer, 2016:10). However, successive City policies show a clear shift towards a more results-based metric. For example, the 2005 NMT Strategy refers exclusively to the delivery of kilometres of bicycle routes, whereas the later Comprehensive Integrated Transport Plan makes reference to behaviour change, education, NMT rights of way, end of trip facilities, law enforcement sensitisation, and other measures (City of Cape Town, 2013:194).

2.2.4 NMT Policy in the study area

As described in Section 3.4 below, unique features of geography mean that mobility in the study area is extraordinarily contested. Reports issued by local community organisations make frequent reference to these problems: meetings with City officials are frequently requested, and, at the time of writing, sustained and well-supported calls for a comprehensive traffic study of the area have been met with the announcement of such a project (Herron, 2016). The recent Far South Strategic Environmental Assessment, or SEA (CSIR, 2015), provides a detailed account of the study area's current transport situation. Of relevance to non-motorised transport are the following:

- "severe levels of localised traffic congestion" (24), resulting in compensatory behaviours by motorists, and in particular, minibus taxis (rat-running, illegal overtaking on the road shoulder or mounting of the sidewalk).
- the "low density nature of the majority of the Far South" (9) and "end of line" (36) location constrain public transport provision.
- the SEA specifically calls for more consideration of the "very specific transportation needs and behaviours of the urban poor" (10), as well as the development of a "monitoring mechanism to evaluate the relative effectiveness of transport network interventions"[4] (10).
- the SEA explicitly cautions against "exclusive reliance on the provision of motorised transport" (ref with page number) within the Far South, citing the potential for induced demand and "highly significant negative impacts" (51).
- NMT has the "potential to relieve congestion in both private and public road-based transport" (104), avoiding a future in which future transport development in the Far South is "'locked' into private transport" (36). The reference to both public and private transport here indicates that NMT could potentially appeal to both the high- and low-income groups within the study area.
- the open spaces of the study area are explicitly identified as potential NMT routes, although the report mentions that lighting, public furniture and maintenance would need to be considered to stimulate NMT here (101).
- the SEA also proposes that future NMT planning in the study area be developed to "at least the same level of detail" as the current development proposals for roads (17).
- the SEA recommmends that transport planning in the current Southern District Plan (CitySpace, 2011; Town, 2011) should be updated to reflect the recommendations and priorities of the City of Cape Town's Integrated Transport Plan (2013), and the report, "Towards a Congestion Strategy" (2014), as well as the Public Transport Interchange Study of (2015), "specifically with regards to Masiphumelele" (18).
- Rail and bus services to the Far South are both "under-utilised" and infrequent, prone to stoppages and delays, and unsafe (24).

The many references to NMT in the SEA report provide evidence of the extent to which the potential of this mode remains unrealised in the study area, as well as the profound extent to which car-centric planning has left a legacy of congestion that disproportionately impacts what the report terms "the isolated urban enclaves" (34). These are lower-income, higher-density communities, such as Masiphumelele and Ocean View, situated in the midst of low-density, middle-class suburbia. NMT is also identified as uniquely able to contribute to improved accessibility within the study area due to its modest space and investment requirements.

However, one point that the authors of the SEA do not make explicitly is the potential conflict between the oft-cited "semi-rural character" and "open space network" of the study area, and the extent to which NMT users are inhibited from using direct local routes after dark, by that very character. As will be discussed further in Section 4.5.5, it is (as one example) the undeveloped and uninhabited nature of the verges of the M65 that makes walking and cycling there at night unsafe. The use the SEA recommends for this well-located urban infill land is housing ("Medium density residential [development] is to be encouraged on land abutting Kommetjie Road" [CSIR 2015:90]). However, if this housing is intended for middle-class residents, it is probable that it will be built with a degree of fortification that negates any contribution to passive surveillance of roadside NMT routes (Schuermans, 2016; Miraftab, 2012). Alternatively, if this housing is developed for lower-income residents, it is likely to arouse very significant opposition from existing residents[5]. In either case, it is not immediately clear from the SEA how these verges could see development that effectively improves conditions for cyclists.

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4 Within the context of the SEA, and its emphasis on the need for non-motorised and public transport interventions across the Far South, this can be interpreted as a call for monitoring mechanisms that include the assessment of issues relevant to NMT.

5 For example, the Protea Village case in Cape Town, where affordable housing is being contemplated on claimed land in the midst of a very high-income suburb, has seen 21 years of legal challenges from highly capacitated incumbent residents (Dentlinger, 2016).

The section above has considered transport policy in general, and non-motorised transport policy in particular, in the contexts of South Africa, Cape Town and the study area. The following section considers conditions on the ground, as opposed to the framing of state discourse, and asks how these situations promote or inhibit cycling.

2.3 Place, People and Practice

The actual mobility regimes operating on the study area and its metropolitan and national context may differ substantially from policy prescriptions. This section thus grounds the question of how a bicycle level of service assessment tool might be contextually appropriate to the study area by examining how people move within it from a historical and political perspective.

2.3.1 Mobility Regimes in South Africa

The policy review conducted in Section 2.2 above revealed that post-1994 South African policy on non-motorised transport is characterised by the increasing status and priority given to non-motorised transport in official publications, combined with a fragmentary and discontinuous delivery of new physical infrastructure on the ground, and a (somewhat diminishing) degree of disinterest in non-physical infrastructure, such as behaviour change, education, or law enforcement. The aim of this section is thus to situate the experiences of cyclists on the mixed-traffic roadway within politics and history, particularly with regard to the extraordinary violence that marks South African road culture and is the leading cause of death for young people aged younger than 15 (World Health Organisation [WHO], 2015). One of the first salient aspects of South African road culture is the disjuncture between its land transport system - which is heavily geared towards private motorised road transport - and its population. The National Household Travel Survey (2013) revealed that, out of 14.5 million households, only 3 million had access to private motorised transport (Lehohla, 2016). The strong correlation between motorised transport and household wealth revealed in this survey is a driver of the stigma attached to captive use of non-motorised transport in South Africa (Graham & van Niekerk, 2014). However, household wealth, race, and mobility remain closely connected in South Africa, and some transport sociologists have argued that the car-dependency built in countries like South Africa has a political and ideological dimension (Pirie, 2013).

2.3.2 Settler-Colonial Automobility and Urbanity

Clarsen & Veracini (2012) have argued that settler-colonial societies exhibit particular transnational patterns of automobility that may transcend their individual differences, and which are distinct from those of both colonial and metropolitan societies. In particular, they have described the narratives of automobility in societies such as Australia and the USA as simultaneously enabling the conquest of the land through individualised movement over great distances and rough terrain, and the complete disavowal of indigenous presences in that same landscape. The latter was accomplished by means of the car's power to legitimate white occupation via settlers' control of an automotive capacity that was demonstrably and uniquely suited to the scale and scope of the terrain. In contrast to this mobility regime, indigenous peoples were presented as belonging to a "different temporal order entirely" (ibid:894).

Discussing the 'overlander' culture of the Australian Outback, Clarsen & Veracini note that the settlers' "conquest of remote spaces through their bush skills and mechanical ingenuity legitimised their replacement of Aborigines as a new (and superior) indigene" (2012:896), a view echoed by Czeglédy when he links the popularity of the car as a means of self-expression with (white) South Africans' "distinct self-image…as 'rugged pioneers'" (2004:78). Crucially, in addition to their 'colonial' function (legitimating conquest), these automobilities also shaped 'settlement' through their privileging of private rather than public transport:

> …Settler-colonial automobilities are dedicated to attempts to return to a dispersed familial and residential order that is perceived to be threatened by encroaching urbanization. Enabled by individualised automobilities, suburbanisation (which in one way or another characterises all settler societies) may be seen as a parallel move to the founding settler exodus from the metropolitan society.
>
> (Clarsen & Veracini, 2012:895)

The quotation above illustrates the strength of the link between settler-colonial automobility and settler-colonial urbanity. However, any attempt to describe private mobility in South Africa must also reckon with the early history of the bicycle, before the mass automobility era.

2.3.3 The Bicycle in South Africa

Smethurst (2015) provides the first cultural and social history of the bicycle from a global perspective. With reference to South Africa, he notes that by 1896, 1382 bicycles were being imported at the Port of Durban per week, signifying a booming early trade in this prestige import. Their use was initially restricted to colonial administrators and the wealthy, and they carried high status as consumer goods. However, as prices fell and reliability improved in the 1920s, bicycles became a form of mass transport. In contexts that were highly stratified in social terms, this development threatened the status of the elite:

> Bicycling as a cultural practice in the colonies was firstly an indicator of rank, helping to demarcate and maintain social hierarchy. It is significant that bicycling became more widespread where colonial society was more mixed…[As] the cultural practice of bicycling gradually worked its way down the social scale in European colonies…it exposed ambiguities and fault lines in the social hierarchy.
>
> (Smethurst, 2015: 129)

While Smethurst is referring to European colonies in general, Morgan (2016) argues that considerations of class and status played a role in the decline of the mass cycling culture of black males in Johannesburg as late as the period from the 1920s to 1950s. He argues that the relative freedom of movement bicycles provided to Black African men in Johannesburg constituted a growing threat to the developing pass system in the early years of formal Apartheid, leading city authorities to suppress black male velo-mobility. Bicycles offered a medium-distance range of mobility that was difficult to police[6], operated on demand and along no fixed routes, and had become affordable even to the black working classes, whereas state-controlled public transport was easily deployed as a means of urban control (von Schnitzler, 2013). Ultimately, Apartheid planners overcame the challenge posed by non-motorised transport by simply eliminating the 'medium distance' in black commutes, through the construction of peripheral dormitory suburbs that intentionally lacked non-residential functions (ibid).

While South Africa meets the definition of a settler-colonial society employed by Clarsen & Veracini (2012), it is thus further distinguished by apartheid spatiality, and the extent to which the means of mobility were deployed as a tool of control (Czeglédy, 2004). Von Schnitzler (2013:7) states that apartheid was "made functional via infrastructure…as it was at one level simply a grand scheme to channel and police mobility". In what is only its third decade of democracy, South Africa's mobility infrastructure and its road culture continue to bear the imprint of this instrumentalisation.

2.3.4 Apartheid and Enclave Urbanism

This history means that, where South African mobilities are concerned, the engineering logic of maximising proximity and minimising the need for transport, has long been subordinate to segregationist political logic. Czeglédy (2004) offers an account of Johannesburg as a quintessential apartheid city, in which the Group Areas Act imposed a kind of racial zoning that created mono-racial residential suburbs, just as Modernist zoning propounded the creation of mono-functional urban areas. This produced an urbanity that von Gelb and Saul (1981 in von Schnitzler 2013:7) has termed 'racial Fordism'. The resulting archipelago of mostly non-contiguous urban fragments were further partitioned by buffer elements and barriers, especially in the form of highways and railway lines impassable to pedestrians. Moving through this system on public transport symbolised "oppression and subservience" (Pirie, 1993;178). Today, what Schuermans (2016:2) terms 'enclave urbanism'

6 For example, through bicycles' lack of a licence plate identifiable from a distance.

reproduces and extends this fragmentation through a neo-liberal regime of racialised territoriality and spatial policing by non-state actors. This form of urbanity instrumentalises the built environment, and mobility infrastructure, into a carceral complex designed to counter "real and imagined opposition forces by limiting their possibilities of urban movement" (Czeglédy, 2004:66).

In a pioneering study of the history of automobility and Apartheid, Lamont & Lee (2015) argue that motorisation and segregation did not simply coincide in history, but reinforced and co-produced each other, inter alia through the racialised status attached to mobility modes. Between 1950, the year of the Group Areas Act, and 1960, the year preceding Republic, South Africa's fleet of registered vehicles nearly doubled, to 1.1 million, rendering it "one of the most highly motorised countries in the world", in the words of the then Transport Minister, who was referring only to whites[7] (ibid:474). In contrast, the advent of democracy positioned automobility as an individual freedom in the transformation narrative, starting with a sixteenfold increase in new vehicle registrations in the year 1995 (ibid). By this narrative, cycling cannot be an apsirational mode for anyone while it remains a captive mode for many (Boulle, 2013; Graham & van Niekerk, 2014). As Jennings (2016:65) phrased it, "Until bicycle mobility resonates unambivalently with the transformation narrative, its use may remain a symbol of the state's failure to triumphantly emerge into the modern world".

2.3.5 Mobility regimes in Cape Town

In her commentary on social justice and utility cycling in Cape Town, Jennings goes on to make a distinction between 'choice' and 'captive' cyclists, and problematizes their inclusion as a single public in NMT policy. The former group is composed of comprises economically advantaged residents who choose utility cycling from a range of transport modes that are accessible and affordable to them. The latter group cycle because they can afford no other form of transport, apart from walking. Jennings argues that transport planning in Cape Town since 1994 has been dominated by the interests of choice cyclists, who have the means to organise, articulate their demands, and lobby for them, rather than captive cyclists, who do not. Irlam (2016:17) states, in support of this, that "the city's 2011 Bicycle Master Plan focused heavily on recreational cyclists and their needs". Further, local government has identified that a rise in choice cyclists' numbers should mean a fall in road congestion, since choice cyclists are also likely to be car owners (Jennings 2011).

In contrast, captive cyclists' interests have only rarely been articulated directly in the transport planning discourse. This group, which by definition comprises some of the most economically marginalised people in the city, lacks the means to lobby for changes. Moreover, captive cyclists experience the stigma of using a low-status means of transport out of necessity, which in turn means that, for lower-income people, cycling cannot be an aspirational mode of transport. This bifurcation in the two cycling publics is repeated in the City's NMT policy (CoCT 20). As Jennings (2016) has shown, discourses around cycling are not inconsistent across government texts, with NMT sometimes characterised as a valid, aspirational mode of transport, and at other times as a survival mechanism imposed on the least advantaged. The status of 'cyclist' is thus sometimes positioned as a phenomenon to be transcended, rather than aspired to, and the NHTS suggests that non-motorised transport users tend to abandon this mode as soon as they can afford to (Lehohla, 2016). Understanding this distinction may be important

2.3.6 Mobility regimes within the study area

Section 2.3 has discussed the broader political and historical context of South Africa's road transport regime, and suggested that the ambivalent status of NMT in state policy and planning, and in the perceptions of people living in South Africa, at all income levels, is connected to the complex set of meanings and histories attached to mobility. As scholars have established, the results may include stigmatisation of NMT modes and users; this phenomenon is widespread, and has been attested to in Brazil (Jones & Novo de Azevedo, 2013), India (Yedla, 2015), Zimbabwe and Uganda (Bryceson, Mbara & Maunder, 2003) but also the UK (Aldred, 2014) and USA (Sheller, 2015). However, policy and planning also shape urban form itself, through technical standards and guidelines, and the (often unstated) assumptions and values on which they are predicated . An example of this can be found in the urban form of the study area itself, which shows the clear influence of British and American 'neighbourhood unit' planning ideas of the early 20th century, transmitted via discourses such as the series of Urban Transport Guidelines adopted by the Committee of Urban Transport Authorities in South Africa in the 1980s.

As Beukes (2011) discusses at length, the ideas of Perry et al. (1929) and Buchanan (1963) – the primacy of functional road hierarchies, through-traffic elimination, cellular local areas with closed internal road networks bounded by high-volume arterials, curvilinear layouts with cul-de-sacs, and centrally located neighbourhood amenities – were officially adopted in design guidance in South Africa, in order to achieve neighbourhoods free of "traffic nuisance" by "actively discouraging route continuity" (Beukes 2011:39). As will be shown in Chapter 4 of this dissertation, the channelling of all traffic between neighbourhood units through a single arterial and its intersections is a major influence on non-motorised trips in general, and cycling in particular, within the study area.

This section has briefly discussed the mobility regimes prevailing in, successively, South Africa, Cape Town, and the study area itself. The following section examines to what extent the study of a self-selecting group of cyclists may be taken to represent the view and experiences of the community as a whole, through a survey of recent cycling ethnography, and in particular on how internal dynamics unique to the practice of cycling may differentiate groups of cyclists from others who use bicycles, from their own communities, and from the residents of the Far South more generally.

2.3.7 Cycling Identities: Race, Class, Gender and Beyond

The aim of this section is to problematize the practice of cycling by discussing the implications of riding a bicycle, with reference to the specific context of low-cycling, car-dependent societies in general, and South Africa's mobility regime in particular. Like all transport modes, (Horton, 2007 in Aldred, 2012, emphasis Horton's) contends that cycling is:

> Never just cycling; it represents various prescribed or proscribed behaviours…the motorised street is not just a place of transit but also an arena of identity formation, where transport modes have complex, differentiated implications for social identities. Those societies socially and spatially dominated by motor vehicles to the detriment of other road users are likely to generate essentialised and stigmatised 'cyclist' identities. Where cyclists are treated more equitably, a 'cyclist' identity may be constructed differently and perhaps be less salient…
>
> (Aldred, 2012:60)

While this study does not aim to provide a sociological account of cycling identities among the study participants, there are several aspects of such identities that are relevant to any discussion of cycling practices in the study area. Firstly, as Aldred mentions argues above, cycling identities in highly motorised societies are likely to be 'essentialised and stigmatised'. It follows that prospective cyclists in such contexts are more likely to practice cycling deliberately, advisedly and consciously than would be the case in countries like the Netherlands, where cycling is unremarkable (see in Section 2.4.2). The manner in which people who ride bicycles perceive of their collective and individual identities, in turn, has an influence on how and where they ride bicycles. For example, Steinbach et al., with reference to Bourdieu's concept of cultural capital, have argued that cycling can offer "a certain... distinction to those whose identities are not threatened by the possibility of poverty being the reason for cycling" (2011:1130). This is also true for other road users, particularly motorists. It can thus be argued that cycling identities are themselves determinants of cycling when they are situated within the "local mobility culture" of the study area (Jensin, 2009 in ibid:1124). To the extent that they influence behaviour, cycling identites ought therefore to be included in any discussion on the assessment of the 'cycling environment'. For this reason, several further arguments in current cycling sociology literature are discussed below.

7 In that year, roughly 100,000 vehicles out of 1,1 million were owned by non-whites (ibid).

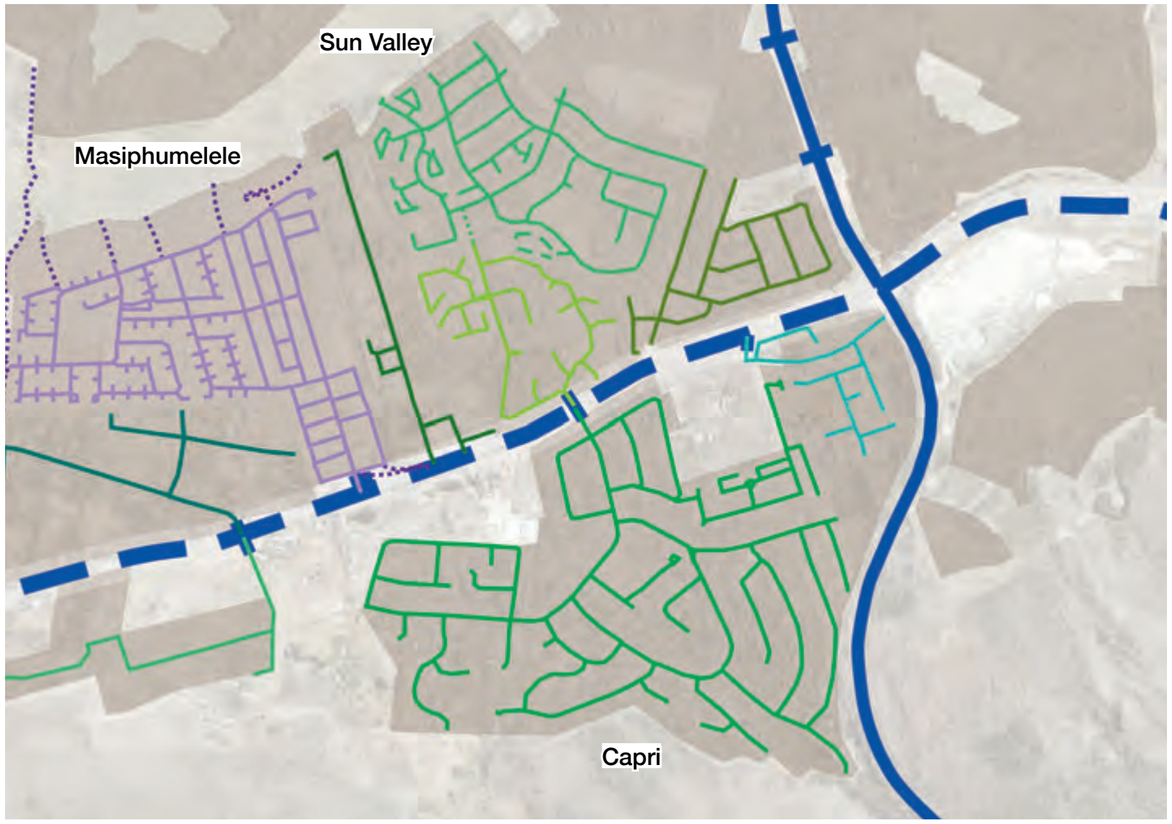


Figure 4: (above) The newer neighbourhoods of Capri, Masiphumelele and Sun Valley in the study area.

Every street grid in colour is accessible from only a single point. Capri, Masiphumelele and the section of Sun Valley in colour are particularly constrained, as Masiphumelele's sole exit, to Kommetjie Road, is an unsignalised intersection, while Capri and the dark green section of Sun Valley share the same signalised intersection as their only exit to Kommetjie Road.

Figure 5: (left) Neighbourhood Units and Road Hierarchies - a comparison between official guidelines and road layout within the study area.

Source: Urban Transport Guideline 7, issued by the Committee of Urban Transport Authorities, 1989, in Beukes (2011:50)

Figure 2.13: Hierarchy of Internal Township Roads. Functional hierarchy is defined even within single category of roads, in this case residential access roads

2.3.7.1 Competence, Stigma and Right to the Road

In a country like South Africa, with its high road death rate (Lamont & Lee, 2015) and widespread prevalence of transport poverty (Lucas 2011), transport-related identities are highly salient. In concrete terms, this means that the stigma associated with a mode such as cycling, especially where cycling may suggest poverty on the part of the rider, may be internalised by cyclists. Aldred has argued that this stigma can affect cycling behaviour, "for example, in terms of road positioning and what it says about the attitude of the cyclist towards other road users" (2012:254). Stigma also operates on cyclists in the decisions of others, particularly motorists: for example, in their aversion to group cycling (when cyclists ride abreast). For motorists in low-cycling countries, cyclists are guests on the road, who should use as little space as possible; consequently, cycling cannot be social, because cyclists must ride in single file, so that road users with access to greater speed are not made to lose time by waiting to overtake (Aldred 2014). Writing about London, Aldred illustrates the extent to which automobility and the efficient journey constrains the different set of possibilities of the cycling journey when she writes that "cycling two abreast breaks an unwritten rule of road space – the road is not a place for socialising, but for individualised utility travel" (2014:13).

Although peer-reviewed research on motorists' perceptions of cyclists is lacking in the South African context, there is a relative abundance of such literature in contexts such as the UK and USA. A study by the UK Department for Transport found that other road users tend to assume, in interactions with cyclists, that the latter are "incompetent, ignorant, illegal and unconcerned for their own or others' safety" (Alred 2012:254), attesting to the strength of the 'othering' process in this context; in contrast, the report found no equivalent 'motorist' stereotype among cyclists. This situation is comparable to that in South Africa, where, despite a long history of the very high road fatality figures caused by motorists, and a share of the fatality rate that is 3 or more times their modal share[8], it is cyclists who are frequently exhorted by safety campaigns to take responsibility for their own survival.

Aldred (2012) discusses three ways in which individuals manage the stigma mentioned previously. The first of these is 'identity negotiation', in which where cyclists' tactics may include heightening their own visibility and asserting themselves, distancing themselves from 'those' other cyclists, and using 'narrative resistance' (Ronai & Cross, 1998 in ibid:255) to resist discursive constraints that position cycling as deviant, and produce alternative constructions of cycling. The second of these is concealment (or the managed display) of the cycling identity and its 'props'. In practice, this could inform cyclists' decisions about where and when to ride, and how to claim space in the 'motorised street' (see Section 2.4.1). The final means of stigma management draws on individuals' other identities to compensate for or transform the stigmatised identity, such as with high-status markers. In South Africa, where non-motorised transport is strongly associated with captive users and poverty (Wray et al., 2014), these practices may mediate between the perception of cycling and the manner in which individuals aim to be perceived.

The three methods of stigma management mentioned above impose a burden on cyclists, since, "as befits a stigmatised group", cyclists are "often expected to possess a higher level of knowledge, skills and stuff than other mobile citizens" (Aldred, 2012:260). This finding is reflected in cyclists' self-evaluation of the minimum skills required to be considered a 'good cyclist', which includes carrying essential items seldom integrated into bicycles in low-cycling contexts (such as lights, which must be charged, and bulky, heavy locks), the ability to carry out maintenance and mechanical fixes, and being seen to wear high-visibility clothing, helmets, and lights strong enough to be seen by motorists. The pressure on cyclists to meet standards of armour and visibility set by motorists is another factor enhancing the unevenness of power of what Goffman (1963 in Aldred, 2012:260) called the "particularly discrediting social interactions" that occur between cyclists and motor vehicles.

8 In Cape Town, cycling modal share is estimated at between 0.5 and 1%, yet accounts for 3% of fatalities (Bruun et al., 2016 in Jennings, 2016:54).

Aldred sums up the preceding arguments as a dilemma faced by cyclists, who can either risk being seen as 'incompetent' or 'too competent' – either not fast and agile enough to take up space in the motorised road, and hence an obstruction to 'traffic', or too fast and agile, and hence deviant, risk-seeking and heedless (ibid). Under automobility, in which only motor vehicles have displaced all other modes as the sole legitimate occupiers of the road , neither identity can be 'good enough' to earn cyclists an uncontested place on the roads. Aldred's framing of cycling identities as a dichotomy is a useful contribution to the context of Cape Town. Many scholars have found that the two worlds of cycling described above – the 'too-competent' (usually recreational) cyclists and the 'incompetent' (usually commuter) cyclists – are reproduced within the organised cycling lobby, as well as in official decision-making (Jennings, 2016). One manifestation of this divide is the promotion activities of cycling charities funded by recreational cycling, where high-visibility vests, helmets and lights are distributed to passing riders. This equipping of ('incompetent'), usually low-income commuter, cyclists by 'too competent' sport cyclists can be construed as a form of respectability politics, in which cyclists, here positioned as defective cars, 'tool up' to the minimum acceptable standard (as set by cars). It could be argued that, by promoting safety in this way, cycling advocates do much to reinforce automobility as the norm for urban transport, and the motor vehicle as the natural occupier of the road.

The various kinds of contestation within cycling identity discussed above have been explored in some depth in order to provide a general conceptual framework to explain of the many forms of bias in regarding cycling populations, particularly in terms of race and income, given the marked disparities in this regard between the three communities studied in Chapter 3.

2.4 Mode: what cycling means in the city

2.4.1 A brief history of spatial planning for commuter cycling

This section discusses some approaches to the problem of assessing and describing interactions between cyclists and their environments, and contextualises these within the history of planning for cycling.

2.4.2 The divide between emerging and established cycling contexts

Several studies have shown that there are significant cultural differences in how cycling is practiced in emerging and established cycling contexts (Aldred, 2012; Mullen et al., 2014; Stehlin, 2014). Established cycling contexts include countries with a high modal share for cycling. These include the Netherlands and Denmark, among high-income societies, and countries such as India and the People's Republic of China, among lower-to-middle income societies. While the literature on cycling within high-income established cycling contexts is relatively large (van Goeverden et al., 2015), it is only relatively recent that serious scholarly attention has begun to be paid to this form of mobility in emerging cycling contexts (Vivanco, 2013). Many questions about the relationship between 'cycling' and what policy documents routinely categorise as 'hard' (physical) and 'soft' (non-physical) determinants, therefore remain to be answered (Western Cape Department of Transport and Public Works, 2010).

Scholars in the Netherlands have focused on the causal relationship between such 'soft' factors as legislation and legal liability, the teaching of bicycle mobility in schools, the image of cycling in the media, and the relationship between cycling and national identity. The result of these combined strategies has been the normalisation of cycling across Dutch society since the 1970s (Pettinga et al., 2009; Kuipers, 2013). In established high-income cycling contexts, the practice of cycling seldom constitutes a meaningful sub-cultural marker, due to the fact that cycling is widely perceived as a universal practice. In the Netherlands, for example, "[cycling] is neither a conscious lifestyle nor a political statement. It is not associated with a particular social class or religion…[it] In the Netherlands, the bicycle is a means of everyday transportation, not just for students, sportsmen or the ecologically-minded, but for everyone" (Kuipers, 2013:2). In tandem with this cultural normalisation, physical cycling infrastructure in this context tends to present certain normalizing characteristics (van Goeverden et al., 2015:411):

- It is comprehensive, covering the same extent as other types of mobility infrastructure.
- It is predictable, with a uniform set of surfaces, widths, signage systems and intersection systems at the national scale.
- It is perceived to be at parity with infrastructure for motor vehicles, receiving consistent and substantial investment for maintenance, upkeep, expansion and innovation.
- It is well integrated with other modes of transport, making for relatively seamless intermodal transfers.

Further, the effects of 'hard' and 'soft' cycling determinants are difficult to isolate in established high-income cycling contexts, since cycling is, particularly in the case of the Netherlands and Denmark, so deeply enmeshed into everyday life and the built environment that bidirectional effects between the physical and non-physical determinants of cycling are difficult to isolate (Handy, van Wee & Kroesen, 2014). For this reason, cycling environment analysis tools derived from high-income established cycling contexts have been excluded from this study. This is due to the fact that they are, in practice, not standalone tools, as they are in low-cycling countries, but complementary to the dominant infrastructure, which tends to be segregated from motorised traffic.

At present, the relative influence of these 'hard' and 'soft' determinants in emerging cycling contexts is the subject of much debate. Proponents of an infrastructure-first approach have argued that the provision of infrastructure is necessary and sufficient to support pioneer cycling constituencies at the very low modal shares seen across the Western world. This 'build it and they will come' approach has been widely studied and adopted (Furness, 2005; Pettinga et al., 2009; Vannini, 2011; Lugo, 2013; Vivanco, 2013; Vanderschuren et al., 2014; Lubitow, Zinschlag & Rochester, 2015) across emerging cycling contexts, particularly in the developed world.

However, some critics, particularly cycling sociologists, argue that, as per the title of Aldred and Jungnickels's (2014) widely cited work, "culture matters for transport policy". These scholars argue that building infrastructure in the absence of a cultural vision for cycling risks perpetuating the practice of cycling as a transgressive and marginalised mode, and leaving the overarching framework of what automobility[9] intact. Critics of the infrastructure-first approach contend that funding physical infrastructure for cycling, in the absence of efforts to produce other, non-physical types of change, may entrench cycling as a subculture, resulting in infrastructure that reproduces political marginality in spatial terms, while also failing to improve safety, modal share, or inclusivity (Aldred, 2010). A recent survey of 24 studies on non-physical influences on cycling by Willis, Manaugh & El-Geneidy (2014:577) concluded that, while physical factors are important, "attitudes, habits, social-environment factors and perceptions are integral aspects of travel behaviour", requiring attention in their own right alongside phsyical infrastructure.

2.4.3 The divide between fragmentary and comprehensive cycling infrastructure

While the infrastructure-first question remains contentious in the academy, it is apparent that, outside of a small number of established national cycling contexts and a number of metropolitan emerging cycling contexts within low-cycling countries, cycling still takes place in the large swathes of the worldwide built environment in which dedicated cycling infrastructure is absent. A good example of this phenomenon is the United States of America, "to an historically and globally unmatched extent, a nation of private automobile users" (Vivanco, 2013:3). The USA may be undergoing a cycling boom in large, politically progressive cities (Alliance for Walking & Biking, 2016), where investment in infrastructure is rising. Yet the majority of U.S urban areas possess little to no dedicated cycling infrastructure, and modal share as a whole has remained under 1% since the 1970s (AASHTO, 2012). This discrepancy between concentrations of dedicated cycling infrastructure in metropolitan areas and the absence of such infrastructure elsewhere may explain the emphasis on built

9 In this sense, automobility refers to a state of unquestioned legitimacy for the private motor vehicle, at the expense of all other modes of transport (Vivanco, 2013).

environment assessment tools within national and state-level policies in the USA. These tools, which are essentially a measure of how compatible motor vehicle infrastructure is with cycling, are far less prominent in established cycling contexts such as the Netherlands and Denmark, where cycling is commonly practiced on an entirely segregated[10] and cohesive system (van Goeverden et al., 2015).

Despite great differences in access to private motor vehicles, South Africa's cycling infrastructure presents many similarities with that of the USA. The city's formal bicycle facility network is fragmentary (see the introduction to the study area in Chapter 3), meaning that most cycling takes place away from dedicated NMT facilities. Private motor transport has long been privileged at the expense of public transport (CSIR, 2003) nationally, and in Cape Town, there has been systematic underinvestment in public and non-motorised transport (in comparison with modal share) for decades (ibid). Until recently, NMT users also constituted the bulk of fatalities from motor vehicle collisions (Macozoma & Ribbens, 2004)]. The relative scarcity of dedicated cycling infrastructure in South Africa, coupled with the widespread practice of cycling (albeit at low rates) (Statistics SA, 2014), underscores the importance of assessing the compatibility of cycling with the country's transport infrastructure as a whole, which overwhelmingly reflects the priorities of the private motor vehicle (Czeglédy, 2004), as opposed to the fragmentary cycling infrastructure system.

Studies have shown that the presence of cycling infrastructure only comes to be a principal determinant of cycling once such infrastructure constitutes a minimally comprehensive system (Vivanco, 2013). While the definition of 'minimally comprehensive' is contentious, scholars have suggested that this term should be applied to systems that, on their own, provide access to the entirety of a built environment, and thereby constitute a lower-density but roughly accurate facsimile of the higher-order movement system for motor vehicles (Saelens, Sallis & Frank, 2003). In practice, this usually means that any route for motor vehicles that can be considered a through-route or arterial road should possess dedicated cycling infrastructure, or that the same route is served by an equivalent route within the cycling network (Mullen et al., 2014). However, in the great majority of emerging cycling contexts, cycling infrastructure is of the fragmentary kind. These 'archipelagos' of cycling infrastructure have been shown to have little impact on cyclists' route choices in emerging cycling contexts. The reasons for this may include the following (Krizek & Roland, 2005:65):

- The cycling infrastructure does not function as a network – it does not link a sufficient number of key trip origins and destinations – and is therefore perceived as unreliable for navigation on its own.
- The infrastructure does not lie along cyclists' preferred routes (i.e., those that are direct, safe, or preferable in some other way) and using it would therefore require a detour, or a deviation from routes familiar to users of other modes.
- The infrastructure exists only where the needs of motor vehicles allow, and disappears where the geometry of motor vehicles moving at speed requires more space, e.g. at intersections (where the bulk of bicycle collisions occur).
- Using the infrastructure requires repeated entry and exit into motor traffic flow, which is in perception and in reality more dangerous than continued travel within the motor traffic flow.

In the absence of comprehensive cycling infrastructure, the profile of those who choose to cycle tends to reflect a relatively risk-seeking group of expert cyclists (Aldred, 2012), who are comfortable in motor traffic and for whom fragmentary cycling infrastructure offers little perceived benefit, in the sense that they are unlikely to deviate from their route in order to take advantage of it.

10 'Segregated' here refers to the higher-order, settlement-wide network of cycle streets. Much Dutch cycling takes place on mixed-traffic roads, but these are not easily comparable with mixed-traffic roads elsewhere, due to a marked difference in modal hierarchy (with vulnerable road users given the highest priority) and motor traffic speeds and volumes effectively controlled through a raft of 'hard' and 'soft' measures (Buehler & Dill 2015).

Comprehensive cycling infrastructure networks remain a rarity in emerging cycling countries, and are certainly rare in South Africa, while cycling is still practiced countrywide in the absence of dedicated infrastructure. This discrepancy reflects the fact that bicycles, as wheeled vehicles, are suitable for use on any sufficiently smooth surface, provided that motor traffic conditions permit.

A dramatic illustration of this feature of the contemporary South African built environment can be found in the number of cases in which cyclists have no choice but to take the freeway (from which bicycles are generally banned) in order to travel between built-up areas separated by various barriers. The same is true for pedestrians, who, (although they too are banned from freeways), are a common feature along the road shoulders of the South African urban landscape (Vanderschuren et al., 2014). The human costs of such a system are high: among the five most dangerous roads for pedestrians in Cape Town in 2005, four were freeways, and thus officially off-limits to pedestrians (Beukes, 2011:53).

2.5 Cycling Environment Assessment Tools (CEATs)

2.5.1 Introduction

This section introduces the concept of level of service, one of the main approaches taken in the development of early CEATs, and discusses several more recent alternatives. The section concludes with a discussion of the status of, and prospects for, Bicycle Level of Service in South Africa, as well as a survey of potential alternatives that could inform the design of a South African CEAT.

2.5.2 The Problem of Assessing the Cycling Environment

Over the past two decades, interest in assessing the built environment for non-motorised transport has grown rapidly, although some of the foundational texts date back much earlier, such as Jane Jacobs' The Death and Life of Great American Cities (1961). Efforts to render these assessments more systematic, and more easily comparable over time, have since been made in many fields. In transport planning, there are various tools for measuring walkability and cycleability. Many other tools are drawn from public health literature, and aim at combatting physical inactivity (Fraser & Lock, 2011). Starting in the 1960s, the fields of social work and criminology have yielded approaches such as 'Crime Prevention Through Environmental Design' (Spinks, 2001) and influential successors such as the 'broken windows' theory and 'situational crime prevention' (ibid).

2.5.3 What is 'Level of Service'?

This section introduces the concept of 'level of service' (LoS) and describes its emergence as a de facto international standard measure for roadway performance. In the absence of a common frame of reference for the evaluation of transport infrastructure, the concept of 'level of service' operates as a de facto international standard of comparison. Even in recent years, when more attention than ever before has been paid to assessing the built environment for non-motorised transport, influential cycling groups continue to frame their activities in terms of BLoS.

For example, the League of Illinois Bicyclists encourages professionals and the public to "justify recommendations (for planning) using quantifiable planning tools such as Bicycle Level of Service" (2015:9). Move DC, Washington DC's transport authority, "seek(s) to improve at least one letter grade of BLOS [on certain streets]…per year" (DC, 2014:61). The Active Travel Act for Wales identifies 'B' as "the minimum level of service" on all active travel routes (Welsh Government, 2014:29). In addition, Australia's most recent National Cycling Strategy has developed 'a Level of Service approach that applies to all road users' (Austroads, 2014:30), citing in support of this effort the benefit of 'comparability of the LOS metric across transport modes'.

Level of service, especially as applied to motor vehicles since 1965 (Epperson, 1994), is a measure of flow, or throughput. For a given traffic volume along a given roadway, Level of Service 'A' signifies that traffic flows freely, while LoS 'F' signifies static congestion (TRB, 2010:2-9). LoS is calculated from variables relating to traffic, signalling and roadway geometry. However, LoS is often mistaken for

a quantitative measure, when in fact, it is a “qualitative description of operational conditions within a traffic stream, and their perception by motorists and/or passengers” (Epperson, 1994:9).

Its rise to prominence is strongly associated with the US interstate highway programme of the post-war era, and two highly influential geometric road design guidelines, the FHWA Highway Capacity Manual (HCM), and the AASHTO A Policy on Geometric Design of Highways and Streets (or ‘Green Book’). Neither of these books in fact, mandate that LoS be the primary concern in road design in urban areas, and both are concerned with the design of freeways. Nonetheless, both these sets of guidelines developed into “deeply ingrained engineering conventions” that were systematically applied to higher-order roads in urban areas (Schmitt, 2016:1). These transport planning practices were disseminated internationally as best practices in road engineering.

2.5.4 Level of Service in South Africa

Level of Service was widely adopted in South Africa as a foundational concept in transport engineering. It is included in the South African Pavement Engineering Manual (SAPEM[11]), which states that “in South Africa, roads are categorized according to the importance and level of service required” (SANRAL, 2013;8) and in the Draft Code of Practice for the Geometric Design of Trunk Roads (GDTR). The latter defines the Level of Service concept as “a qualitative measure describing operational conditions within a traffic stream and their perception by drivers and/or passengers” – a verbatim quotation from the HCM (CSIR, 2001:1-3). Both sources refer closely to US models. The GDTR states plainly that “the geometric design standards of the southern African rural road authorities were derived largely from American and English practice” (CSIR, 2001:i). In the chapter on road design in the current SAPEM, the American Association of State Highway and Transportation Officials (AASHTO) is cited 40 times (SANRAL, 2013:8-25). The City of Cape Town’s Minimum Standards for Roads and Stormwater Design state that “for all formal roads within the City of Cape Town, a basic minimum level of service (LOS)…is required” (CoCT, 2014:27). This reflects the widespread and deep-seated acceptance not only of Level of Service as a concept, but of a penumbra of assumptions associated with it.

2.5.5 Level of Service and the making of the modern roadway

Among the most important of these for cycling planning is that the roadway’s central purpose is the throughput of vehicles at maximum efficiency and minimum impedance[12]; in consequence, pedestrians and cyclists are conceived of as obstacles to efficient travel. Bonham (2006:70) - through a detailed account of road transport in Adelaide, Australia, in the course of the 20th century - discusses how road users other than motorists came to be positioned as ‘dissonant travellers’, while motorists came to be normalised as synonymous with ‘traffic’. She describes how various processes were then underway in “British, North American and Australian cities whereby street users, street spaces, and streets, were classified according to the speed and order of travel” (Bonham, 2006:61).

This is borne out by social history scholars such as Oosterhuis (2016:246), who stated that in “in the United States, Britain, Canada and Australia, where the bicycle was pushed out by the car to a much greater extent than in most European countries, it [the bicycle] is more frequently used for recreational and sporting than for utilitarian purposes”. Increasingly, speed came to be the foundational category for the analysis of movement. This factor combined with what Bonham (2006:70) describes as a key innovation in urban circulation, the “conceptualisation of travel as a point-to-point journey” (in which the throughput function of streets was valorised over their access function), laying the groundwork of automobility (see Section 2.3.2). Crucially, in this regime, motorists came to be considered the rightful occupants of the roadway due to their superiority in speed, while slower-moving road users were physically and conceptually marginalised and presented as obstructions to traffic (rather than traffic). Resistance to this regime could be characterised as obstructionist and anti-efficiency. By the mid-20th century, in the developed English-speaking countries cited by Bonham (2006), normalising discourses had rendered the efficient journey synonymous with the motorised journey, and the journey itself with the most rapid movement between trip origin and trip destination. A distinction had been established between motorised road-users, to whom the automobility regime offered speed, and non-motorised road-users, to whom it offered safety. The degree of safety on offer, however, was delimited by the imperative of rapid travel that organised the system. As Bonham notes, “travellers who resisted the ordering of the speedy street could be positioned as irrational because they simultaneously resisted the order of safety” (Bonham, 2006:65). Drawing on Foucault, Bonham (2006) describes the growing number of ways in which these dissonant road-users were disciplined, including through infantilisation: “The motoring body was invariably studied as an adult body but investigations of the pedestrian often targeted the body of the child” (Foucault, 1977 in Bonham, 2006:66).

The concept of (automobile) Level of Service[13] is thus intimately tied to a discourse that normalises motorised traffic as all traffic. This has a bearing on Bicycle Level of Service, since any attempt to broaden the concept of Level of Service to encompass a mode of transport that is very different from the motor vehicle must reckon with the assumptions that underpin (automobile) Level of Service.

2.5.6 The Development of Bicycle Level of Service: the Davis Index (1987)

Epperson (1994), subtitled Toward A Cycling Level-of-Service Standard, summarises early approaches to the problem of systematically describing how roads served cyclists. The first was developed by Davis in 1987, as a “mathematical model for indexing bicycle safety to physical roadway features and other pertinent factors” (ibid:9). This foregrounded the measurement of the built environment (as opposed to other factors) as the primary determinant of cycling practice (see Table 2-3 for the full set of criteria). The Davis Bicycle Safety Index Rating introduced several features, some of which have become the standard – note that the higher the score, the lower the performance (ibid:10):

- There are separate tools for road segments and intersections.
- Roadway geometry (lane width) and traffic (per-lane traffic volume, traffic speed) are the three main inputs.
- Road quality is assessed as a single cumulative score, “pavement factors”(page number!), for the presence of elements such as drainage grates and potholes.
- A second score, “location factors” (page number!), tallies points for the presence of on-street parking, turning lanes and driveways, and subtracts them for factors such as raised medians or paved shoulders.
- Curiously, the presence of industrial or commercial land uses are included as two individual negative factors in this Index.

The fact that the presence of industrial or commercial land use detracts from performance in the Davis Index is at odds with later sources, for which these land uses indicate a cluster of potential trip destinations, and thus a high priority for NMT infrastructure. Epperson (1994) criticised the Davis Index for the overemphasis that the Pavement and Location Factors scores received in the weighting of the Index, while noting that Davis had succeeded for the first time in identifying the three critical factors “common to all cyclists” that affect “comfort, convenience and perception of safety” (ibid:11) – namely, per-lane traffic volume, traffic speed, and lane width. Epperson makes a further point that has proven prescient. While Auto LoS depends on the volume of automobiles themselves, Bicycle LoS depends on exogenous factors, almost entirely linked to motorised traffic (ibid). Unlike Auto LoS, which measures the movement of objects through *space*, Bicycle LoS could thus be said to measure the movement of objects through the *space left over*.

11 It should be noted that, unlike in common South African parlance, ‘pavement’ in this title refers to the road surface for wheeled traffic. The term ‘sidewalk’ is used in engineering to refer to footpaths.

12 Impedance, as used here, is a common term in transport engineering, referring to factors that constrict or interrupt the flow of vehicles. The analogy with the more common meaning, of resistance to the flow of electrical current, is telling.

13 Used on its own, ‘Level of Service’ is very widely used in transport planning to refer to automobile level of service.

Surveying bicycle planning in the USA three years after Epperson, Turner, Shafer & Stewart noted that the marginality Epperson refers to above was reproduced in planning practice (1997). For example, bicycle assessment tools at state and city level were still primarily designed around the existing data available, which was in most cases that required for automobile planning (ibid). Further, out of 15 assessment tools considered (including the Davis Index), only 2 formally incorporated the input of cyclists, while and only 1 considered average bicycle speed. BLoS and other assessment tools at this time can thus be said to reproduce, through internal processes, the marginality of cycling on the roadway.

2.5.7 The Real-Time Human Perceptions Model (1997, 2003)

Writing in the same year, Landis, Vattikuti & Brannick could still state in their report, subtitled Towards a Bicycle Level of Service (1997:119), that "there exist few, if any, calibrated and transferable models that estimate bicyclists' perceptions of the quality of service in the on-road cycling environments in US metropolitan areas today." The authors state that state of affairs had persisted despite the demand for such a supply-side evaluation of existing roadway facilities, and fierce competition between modes for transport funding. At the time, almost all models for bicycle planning in the USA were based on the approach of "'quantifying bicyclists' perceptions of the magnitude of the hazards (stress, or conversely, comfort) of traveling within the shared-roadway environment" (ibid:120.

However, none of the models were based on what the authors deemed to be a "statistically robust number of observations" (1997:120). They claim that the proliferation of subjective cycling environment evaluation tools then occurring prevented longitudinal assessments of the cycling environment, since the same participants could not be found for follow-up studies. In consequence, they emphasise, as did Epperson (1994), that the BLoS is a qualitative measure of cyclists' perception of the environment (with F being worst and A being best), and that these perceptions must be grounded on a well-supported statistical correlation with observable physical route attributes, if they are to be reliable. The lack of a reliable mathematical model for BLoS further prevented cycling from being incorporated into the routine planning processes used for motorised modes, maintaining its exclusion from conventional travel demand models for urban areas (Landis, Vattikuti & Brannick, 1997).

Landis, Vattikuti & Brannick's major contribution was to achieve, by means of a correlation analysis, a high degree of statistical reliability in matching cyclists' (n=150) real-time perceptions of safety (along a mixed-traffic, 27km urban course representative of the urban US) with quantifiable physical attributes of the route[14] (ibid:122). While the 1997 study considered route segments (links) only, excluding intersections, a 2003 follow-up study (n=60) used the same method for intersections (through-lanes only), and was able to reproduce the results (Landis et al., 2003:102).

The two models above have proven influential, notably through their inclusion in the highly influential 2010 Highway Capacity Manual. However, scholars have pointed out several limitations. Firstly, despite the diversity of the USA, all fieldwork took place in Florida, meaning that values are not necessarily representative of other regions. Secondly, the fieldwork took place before infrastructure types that are now widely used, such as bicycle signalling at intersections or physically segregated lanes, were available. Thirdly, the method is not compatible with shared-used paths and streets, which have also become widely used since the study took place (Asadi-shekari et al., 2013).

2.5.8 The Highway Capacity Manual (2010)

The next great advance in Bicycle Level of Service came in 2010, with the release of the 5th edition of the HCM, which introduced Pedestrian and Bicycle Level of Service measures and combined these with traditional (Automobile) Level of Service to produce a Multimodal Level of Service assessment (TRB, 2010). The HCM represented the first time that a complete toolkit for assessing the performance of the built environment for pedestrians and cyclists, had been delivered to local and state governments of all sizes, in a way that was easier to integrate with conventional transport planning than many previous approaches. Further, the HCM was a product of the federal government, and thus a major signal that cycling, in particular, would henceforth be considered a form of transport rather than a leisure activity. While this introduced bicycling needs into the debate, there have also been many critiques of the HCM. The most thorough of these is Huff & Liggett (2014:5), who noted several shortcomings:

- At intersections, the HCM does not include a measure of cyclist delay, such that improving timing for cyclists does not increase BLoS score; it is also indifferent to signals that detect cyclists, or push-buttons for cycling signals.
- An error in the formula relating to Segments and Facilities (see Figure 6), makes it impossible to obtain high (A or B) scores.
- At intersections, the HCM is not sensitive to bicycle-specific treatments, such as bicycle boxes, signals, and markings through intersections.
- Along links, the HCM is not sensitive to coloured paint, striped buffers, or cycle tracks demarcating space for cyclists.
- Along links, the HCM is not sensitive to cyclist crowding, so relieving congestion does not improve BLoS score

Perhaps the most serious shortcoming, however, is the HCM's reliance on the two studies discussed above (Section 2.5.6-2.5.7), which were both conducted in cities in Florida, with a total of only 220 participants (ibid:7). This poses problems for the model's applicability to the great diversity of urban environments in the US and beyond. As the authors state, "the HCM's exhaustiveness and level of detail suggest that it was rigorously tested and validated. It wasn't" (ibid). The use of a 1997 and 2003 model, and no others, to inform a major design tool published in 2010, meant that the HCM was soon overtaken by innovations in the fast-developing 'bike boom' cities such as New York and London (Furness, 2010).

On the other hand, as a federal publication of relevance to every local government in the USA, the HCM's Level of Service paradigm (MMLoS/PLoS/BLoS) represented a major shift in conventional planning, especially for communities lacking dedicated cycling planning capacity of their own. To these practitioners, the HCM delivered a readymade toolkit for cycling planning, signalling that cycling was henceforth to be understood as transport, rather than a leisure activity or sport. Where local governments had policies requiring them to act whenever (A)LoS might be degraded, these could now be indexed to MMLoS instead. This is notably the case in three areas: transport impact assessments, the assessment of developers' fees, and project prioritisation (Huff & Liggett, 2014:60). Despite its drawbacks, the HCM arguably represented an instant capacitation of communities across the US with a cycling environment assessment standard that is "calibrated and transferable", as per the criticisms of Landis, Vattikuti & Brannick (1997) above (ibid). Operationally, the HCM method is defined by four 'units of analysis', each of which is directional (meaning that a two-lane road would have two BLoS scores, one for each direction of travel). As shown in Figure 6, 'Links' are lengths of roadway without stops; 'Intersections' are a single approach to an intersection; 'Segments' are for travel along a link that continues across an intersection; and 'Facilities' are for travel that continues in one direction through more than one Segment (Huff & Liggett, 2014:10). This nomenclature will be used frequently throughout this study. The HCM methodology represents a simplification from (Davis, 1987) model, in that land-use considerations are omitted. A second omission, this time from (Landis et al., 2003), is the observation of motorist behaviour at intersections (e.g. 'overtaking right-turning motorists', or 'left-turning motorists from opposing approach'). The HCM can thus be said to represent a pared-down version of the two preceding studies that informed it, in which contextual information (adjacent land uses, actual driver behaviour versus road design) is excluded.

14 In a comment that illustrates the profound difference between US (and, as has been argued above, South African) road conditions and those prevailing in the Netherlands, the authors also state that children under 13 were excluded from the study due to the risk of cycling in urban areas (Landis, Vattikuti & Brannick, 1997:121).

2.6 Quantitative Alternatives to Bicycle Level of Service Tools

In the preceding section, the origins of both the 'level of service' and 'bicycle level of service' approach were discussed. This section considers alternative approaches to the assessment of the cycling environment that have been widely studied, taken up into municipal plans, or adopted as complements to, or substitutes for, BLoS. Due to the fact that the LoS tools discussed above all contain measures for assessing both links and intersections, as well as the prominence of intersections in defining mobility in the study area[15], tools that exclude intersections from their analysis were excluded from analysis. These tools include the Bicycle Compatibility Index (Harkey, Reinfurt & Knuiman, 1998), and the Level of Service Model for Bicycle Riders (CDM Research, 2013). The following section considers published tools used by planning authorities that involve a mixture of some or all of these approaches. These tools will be are listed in Table 2-1 and their criteria collated in Table 2-3.

2.6.1 Levels of Traffic Stress Model (2012)

Mekuria, Furth & Nixon (2012) emphasise cyclists' tolerance for traffic stress in their approach, which considers the road network as a whole in terms of the connectivity it provides between 'low-stress' links and intersections. In their perceptive framing of the problem of assessing the cycling environment, the authors contend that, in functional terms, a user-centred understanding of cycleability in urban environments may include streets without any cycling infrastructure, where these happen to provide low-stress environments, while excluding streets with cycling infrastructure, where this infrastructure does not in fact reduce traffic stress to acceptable levels. It is this gap that the 'low-stress' approach aims to remedy.

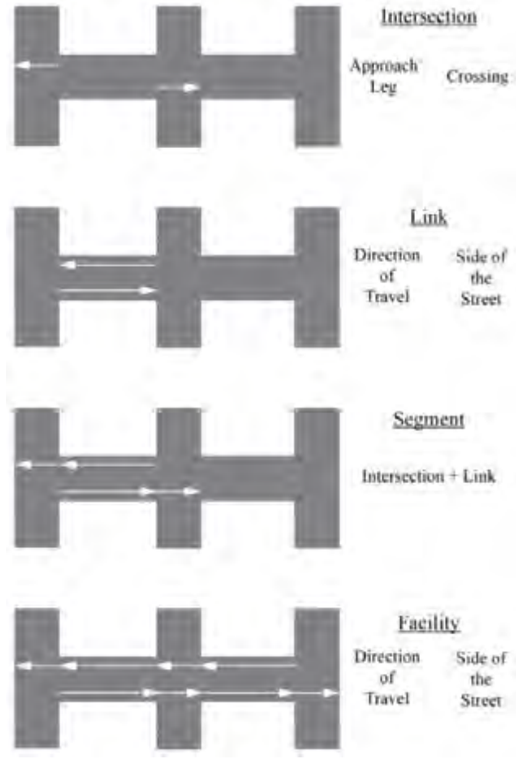
The Levels of Traffic Stress (LTS) model divides cyclists into four classes, based on the levels of traffic stress they will tolerate - in ascending order from Class 1 to 4. The authors have indexed these classes to Geller's (2009) widely-cited 'Portland' classification scheme for estimating propensity to cycle among the general population. In this scheme (see Figure 7), 1% of residents are considered 'Strong & Fearless' (corresponding to Class 4 above), while 7% are 'Enthused & Confident' (Class 3), and 60% are classified as 'Interested but Concerned' (Class 2 – adults; and Class 1 – children) (Mekuria, Furth & Nixon, 2012:11). The remaining 33% of the population that Geller terms the 'No Way No How' group, have no propensity to cycle (ibid). The scheme is anchored by Class 2, which correspond to current Dutch traffic stress standards for bicycle infrastructure (ibid). Class 3 cyclists are comfortable using higher-speed arterials where some accommodation exists for cyclists, while Class 4 represents a profile common in countries where cyclists are marginalised: the highly stress-tolerant, overwhelmingly male, adult cyclist of below retirement age (Mekuria, Furth & Nixon, 2012).

The LTS model also considers the maximum level of detour acceptable (25% of trip distance) (ibid:25). However, stressors from sources other than traffic, such as "crime danger…and absence of lighting" (Mekuria, Furth & Nixon, 2012:15) are excluded, as the authors feel that further study is required before these can be reliably and systematically incorporated into the model.

15 As XX illustrates, the urban form of the study area means that all of the communities in the valley are dependent on a single arterial, the M65. In many cases, cyclists thus lack alternatives to the four-lane intersections that govern movement along the M65.

Figure 7: Geller's classification of Portland's population by propensity to cycle (Source: Geller, 2009:1)

Figure 6: BLoS Units of Analysis (HCM, 2010)



Like the Bicycle Level of Service models, the LTS model functions by measuring physical attributes of the cycling environment, and indexing these to previously established comfort and stress levels (respectively). The difference between the models emerges in their foundational assumption about the degree of physical separation from motor traffic that is taken as a baseline. For example, according to Mekuria, Furth & Nixon, for example, models such as BLoS and AASHTO are implicitly designed for what these models call 'Advanced' or vehicular cyclists, who are comfortable sharing the road with traffic, whereas 'Basic' cyclists seek separation from it. In effect, this means that BLoS criteria are targeted at Geller's 'Strong & Fearless' group, or LTS 1 (2012)[16], a finding that is borne out by the fact that cycling modal share has long hovered at under 1% in the USA.

The practice of dividing cyclists into traffic tolerance classes presents a clear advance on the methodology used to calibrate the BLoS method in the Real-Time Human Perceptions models. Rather than measuring the perceptions of those who already feel comfortable cycling an urban course, the LTS model includes everyone with any propensity to cycle. Although the criteria that the LTS model uses to evaluate the cycling environments include only a small number of physical attributes, the model does include an instrument for network-level analysis that is particularly applicable to the curvilinear postwar neighbourhood design encountered across the USA, and which is widespread in the study area. This provides it with heightened sensitivity to the classic suburban form encountered in the study area, in which fast limited-access arterials constitute the only physical road link between adjacent neighbourhoods. This means that large networks of low-stress streets within each neighbourhood are separated from each other by high-stress connectors and intersections. LTS therefore presents a powerful method of for presenting these mobility constraints graphically, particularly since it also includes land-use considerations. The following section surveys several tools for the assessment of the cycling environment, all issued by local or national government (with the exception of tools included for purposes of comparison only), and all intended for a non-specialist audience.

2.7 Local Government Tools/Mixed Tools

The preceding Sections and considered the development of the Bicycle Level of Service approach to measuring the cycling environment, as well as one alternative, the Levels of Traffic Stress model. These tools are heterogeneous, presenting a mixture of the BLoS and LTS approach, along with a variety of other tools that correspond to particular local realities.

2.7.1 Cycle Route Audit Tool (Wales, 2014)

The Welsh Government's Guidance Active Travel (Wales) Act of 2014 is a comprehensive legislative framework for 'active travel' (defined as walking and cycling) that considers network planning, and the monitoring and evaluation of walking and cycling environments through its Cycling Route

16 This is the opposite of the situation in countries like the Netherlands, where separation from traffic for the general cycling population is a foundational assumption of transport planning (Mekuria, Furth & Nixon, 2012).

Audit Tool. The Act states that prospective active travel routes shall first be selected on the basis of their desirability (in terms of 'directness', which is a function of "distance, time (stopping frequency and delay) and gradient" (Welsh Government, 2014:80). Only then are these routes assessed in terms of suitability, by means of the Audit Tool, on the basis of "coherence, safety, comfort and attractiveness" (ibid). The fact that 'directness' is the initial qualifying criterion is a strength, since it helps to avoid a situation in which NMT routes are provided on the basis of already available space. Since these spaces, especially in urban areas, tend to be vestigial or interstitial, this order of priority has contributed to phenomena like Cape Town's prestige cycle paths running through rail-yard and industrial areas that are deserted outside of working hours, and which are suitable before they are desirable (Jennings, 2015).

This tool offers an interesting advance on others in Table 2-1 in its inclusion of 'network-level' criteria. Although these criteria depend on interpretation of qualitative terms such as 'cohesiveness', they do impose a higher-order assessment on the cycling environment. In practice, this runs counter to the 'supply-side' focus of the Bicycle Level of Service measure, since (as was described in the methodology above) the Welsh tool asks *first* where cyclists desire to travel, and *then* surveys the 'supply' of roadway to find one or more alternative routings to those destinations.

Questions such as whether the street layout offers a fine 'mesh' in general, with intersections generally spaced at less than 250m, or whether links possess 'evasive room' along the roadway (that is, whether there are any barriers barring cyclists from leaving the roadway in an emergency), further reflect a perspective that is unambiguously anchored in the everyday wayfinding and route-selection strategies of cyclists (ibid:Appendix B). This is in contrast with the BLoS method's focus on accommodating new modes within a hitherto car-centric methodology.

2.7.2 Cycling Level of Service Assessment Matrix (UK, 2014)

The Cycling Level of Service Assessment Matrix, drawn from the London Cycling Design Standards (Transport for London, 2014), is comparable in design to other tools included in Table 2-1. Scores are tallied from 0-2 for each criterion, with a multiplier for those deemed 'critical'. While there is some overlap in terminology with the Welsh audit tool, there are also certain differences, as would be expected in a context as specific as London.

Some unique criteria in this tool include the following (Transport for London, 2014:31-32):

- The presence of 'pinch points', or narrowing in the road;
- Speed bumps are scored as a negative for cyclists, while a smooth road free of 'vertical deflections' scores highest; this is in contrast to tools such as the In South Africa, critique of Level of Service has tended to take the form of advocacy for multimodal streets and mobility routes, rather than calls for an overhaul of the methodology used for road planning itself. This may be due to the absence of a well-organised anti-LoS lobby. However, two studies have addressed environment assessment tools for the built environment. The following sections discuss these two case studies in further detail.
- On a network level, permeability (presumably here meaning only for motorised traffic) is scored negatively, with the highest score reserved for when side roads are closed or footways is are continuous. It is not mentioned whether cyclists should be able to access these side streets. It is also not specified how this score interacts with the 'mesh' measure used here;
- Noise pollution is measured in decibels, and air pollution is measured in particulate matter readings. No other assessment tool in Table 74 includes these criteria.
- The Matrix also gives a high score where 'street clutter' has been minimised, leaving 'wayfinding only'. This may reflect an important safety principle in a visually crowded London streetscape.
- The Matrix offers a detailed set of criteria relating to social safety. Listed in order, with their maximum value in parentheses, they are: – 'Risk/fear of crime' (No fear of crime: high quality streetscene and pleasant interaction'; 'Lighting' (Route lit thoroughly); 'Isolation' (Route always overlooked[17]); and 'Impact of highway design on behaviour' (Encourages civilised behaviour: negotiation and forgiveness). The latter criterion is not explained in greater depth within the text, but may have a more fixed 'embodied' meaning within professional practice in the context of London.

Many of these criteria (and in particular the last) are not self-evidently quantifiable through the assessment of physical attributes alone. Criteria such as those used to assess the risk or fear of crime, which refers to the presence of 'ambush spots' along the route, (ibid:32) are highly subjective, and no guidance is given on how these could be compared over time. In this sense, this Matrix represents a major departure from the aspirations to objectivity of tools such as the HCM Bicycle Level of Service measure. At the same time, it is noteworthy that the measures deemed 'critical' in the Matrix are all objective and quantifiable (ibid:30), and most appear in similar form across all of the cycling environment assessment tools listed in Table 2-1. This means that a degree of comparison, across time and independent of a particular assessor, may be possible for 'core' measures. However, perhaps the most salient aspect of the Matrix is its lack of focus on dedicated bicycle facilities in themselves. For example, the presence of a physically segregated bicycle lane is weighted equally with a well-lit road (and is not included within the 'critical' set of criteria) (ibid). This may reflect a commitment to evaluate the cycling environment as a whole, rather than privilege dedicated cycling infrastructure.

2.7.3 Cyclist Level of Service Assessment Tool (CLOSAT) (Australia, 2014)

CLOSAT, issued by VicRoads, the department of transport of the Australian state of Victoria, was included in this study as a recent example of a BLoS-based tool that also incorporates increasingly prominent new bicycle facility typologies Den Hollander, 2014). Examples of these are the advance stop box (giving cyclists a designated stopping space in advance of motorised traffic at intersections), and the 'bike boulevard' or 'quietway' (a route rendered advantageous for cyclists without the provision of dedicated cycling facilities) (ibid:12). While limited in terms of detail, the CLOSAT is of interest due its highly visual nature[18], enhancing its utility to interested non-professionals, and its inclusion of three separate sections (for on-road and off-road bicycle facilities and intersections) within a framework that only requires a modest amount of input data. This renders CLOSAT easy to use, especially at an early phase of network planning or route evalution. Its criteria are included in Table 2-1.

2.8 Strengths and Weaknesses of the Bicycle Level of Service approach

The previous section has traced the development of Bicycle Level of Service, from its first use by Davis in 1987, to its adoption as federal government policy in the HCM in 2010, and surveyed alternative methods for assessing the cycling environment, both issued by local government and produced by scholars. This section discusses the current landscape of BLoS assessment tools, as well as alternative tools for the assessment of the cycling environment, and justifies the inclusion of BLoS and non-BLoS assessment tools in Table 2-1, which contains contextual information on these tools. This section then provides commentary on Table 2-3, which allows for a comparison in time and by country of the criteria used by these tools to assess the cycling environment.

At present, there remains a considerable variation in the literature on what cycling or bicycle level of service might entail. While the concept of bicycle level of service resists easy definition, there are certain similarities between the countries that have produced the CEAT tools considered in this chapter, whether they employ the BLoS approach or an alternative method. Firstly, all of the countries included in the BLoS sample are low-cycling societies; in none of them does cycling exceed 1% of modal share (Mason, Fulton & McDonald, 2015). Secondly, all are English-speaking, reflecting an overlap between dominant language and the national mobility regimes discussed above (see Section 2.3.1). Thirdly, and tied to the second point, all are countries in which 'vehicular cycling' emerged as the dominant paradigm of cycling governance, including through the cycling lobby itself. Fourthly, with

17 This term is used throughout the source text to refer to surveillance.

18 [Insert a selection of images from Den Hollander 2014 here].

the exception of the United Kingdom, all are settler-colonial societies, which, as Clarsen & Veracini (2012) have argued, have mobility regimes distinct from both metropolitan and colonial societies.

Automobility in South Africa has much in common with other the settler-colonial geographies of mobility that Clarsen & Veracini (2012) discuss, with reference to Australia and the United States of America. However, as this section makes clear, automobility in South Africa is also unique among settler-colonial mobilities due to its history of instrumentalising mobilities as an enabling technology of Apartheid. The following section considers two attempts by scholars to design tools for the assessment of the non-motorised transport environment that are contextually appropriate to these unique features of mobility in South Africa.

2.8.1 Walkability in South Africa: the Pedestrian Environment Assessment Tool (PEAT, 2010)

In South Africa, Level of Service thinking has become ubiquitous in current transport planning practice (see Section 2.5.4). Critique of Level of Service has tended to take the form of advocacy for multimodal streets and mobility routes, rather than calls for an overhaul of the methodology used for road planning itself (Beukes & Zuidgeest, 2010). This may be due to the absence of a well-organised anti-LoS lobby. However, two studies have addressed environment assessment tools for the built environment.

Although at the time of writing no audit tool for non-motorised level of service exists in South Africa, Albers, Wright & Olwoch (2010) studied three precedents for pedestrian level of service from Australia, Scotland and the USA[19] and adapted these to a study area in Tshwane. This represents South Africa's first assessment tool for the walking environment (PEAT). PEAT is a noteworthy precedent for this study, since in one sense this study aims to reproduce recommendations towards a cycling equivalent of Albers, Wright & Olwoch's work. In particular, the authors highlight a shortcoming in recent approaches to road safety in South Africa, arguing that it was fragmentary rather than comprehensive, and "curative rather than preventative" (2010:8). They further emphasise that, while some infrastructural factors have been taken into account in road safety campaigns, "no attention was given to pedestrian environments in their entirety" (ibid).

Similarities between this study and the PEAT study include the selection of existing environment assessment tools from outside South Africa and a critical comparison of the criteria used by these tools. Differences between this study and the PEAT study include the fact that sites for the testing of PEAT were selected on the basis of road collision incidents, whereas the site for this study was selected on the basis of observed cycling behaviours and geography. A noteworthy feature of the PEAT study is that a large number of potential sites was were excluded from further study at an early stage of site selection, as these were "deemed to be isolated or unsafe and not suitable for the researchers to visit" (ibid:3), and no sites were visited at night. This limitation attests to the high perception of crime experienced in South African walking environments, as well as, potentially, social, class and cultural differences between the researchers, who are able to avoid sites deemed overly risky, and the walking public, who in some cases cannot. The authors also noted that levels of crime and perceptions of safety in South Africa differed from the contexts of the audit tools surveyed. All of the latter focused on "recreational space for health promotion" (ibid:4), rather than walking as transport. The PEAT authors thus added a host of 'crime' and 'perceived safety' indicators. Of particular relevance to cyclists was the authors' observation that:

> …the presence of surveillance video cameras outside petrol stations and restaurants may instil a sense of safety for pedestrians walking in a commercial area.
>
> (Albers, Wright & Olwoch, 2010:4)

Also of relevance to cyclists is the authors' observation that the quality of road surface matters for pedestrians. This is because motor vehicles may swerve onto the road shoulder or mount the pavement to avoid poor road surfaces, such as potholes, thus endangering pedestrians (ibid:7). The authors recommended that specifically South African land use types, such as informal settlements and gated communities, be included in any future pedestrian environment assessment tool, as well as what they term "behavioural factors" (presumably referring to the observed behaviour of road users, including other pedestrians) (ibid).

The pilot PEAT tool (see Table 2-3), includes a number of criteria absent from the walkability tools surveyed by Albers, Wright & Olwoch, as well as from the CEATs surveyed thus far. The authors' sensitivity to informality along South African roads and pavements is reflected in the high degree of specificity with which they describe obstructions and impediments commonly encountered on South African pavements (ibid:4). Their interest in local safety and perceptions-of-safety measures is reflected in a section on surveillance (for example, of the type provided by petrol stations) and the presence of abandoned buildings, beggars and litter (ibid:7). The PEAT has thus been included in this study due to its particular sensitivity to specifically South African road and roadside conditions.

2.8.2 Context-Sensitive Multimodal Road Planning (2010-2012)

Another major advance in attempts to bridge the gap between transport and urban planning is the series of studies authored by Beukes & Zuidgeest (2010), Beukes (2011), Beukes, Vanderschuren & Zuidgeest (2011), and Beukes & Vanderschuren (2012), all of which deal address the idea of context-sensitive multimodal planning for the developing world. This approach aims to bring non-motorised and public transport modes into transport planning, by linking certain modal hierarchies to given land uses (Beukes 2011). To do this, the authors examine the locational attributes of various land use types in order to generate a value statement for each land use type and density (such as 'We want to maximise the safety of all road users' for a low-density residential area) (Beukes & Zuidgeest, 2010:10). These value statements are then used to generate a modal hierarchy specific to each land

Figure 8: Modal Hierarchy along Voortrekker Road, Cape Town, according to Context-Sensitive Multimodal Planning (Source: Beukes, Vanderschuren & Zuidgeest, 2011)

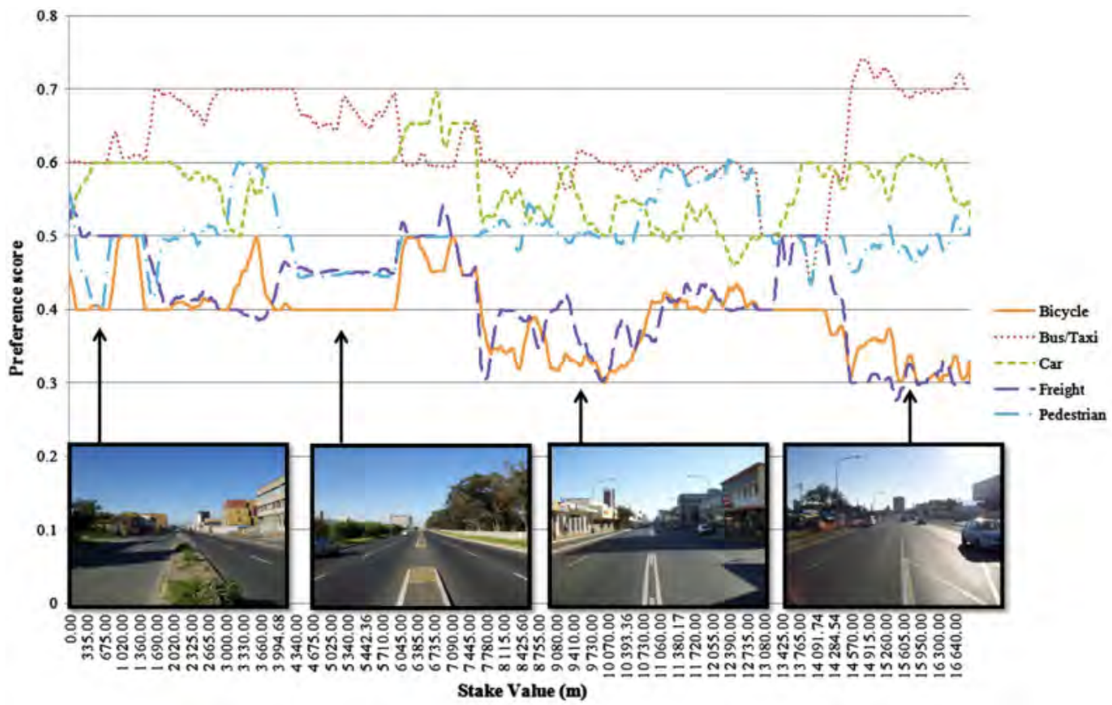


Fig. 3. Relative rankings of modes.

19 These include the SPACES, the Systematic Pedestrian and Cycling Environmental Scan; SWAT, the Scottish Walkability Assessment Tool, and PEQI, the Pedestrian Environment Quality Index.

use type[20]. Since the route being studied - Cape Town's Lansdowne Road - combines many different land uses along its length, it follows that the priority of modes that informing the design of the road should change as neighbouring land uses change (ibid).

Along with a range of other data, the resulting profile along the road thus reflects a series of shifts in modal priority (see Figure 8). These findings were then compared to a traditional Multi-Modal Level of Service analysis for car, bus, pedestrian and bicycle (BLoS) modes, conducted using the HCM method discussed in Section 2.5.8, to ascertain where the normative modal priority suggested by the study differs from the Level of Service rating produced by the MMLoS model. The aim of the latter procedure was to establish whether traffic incidents are more frequent along segments where the Level of Service for a given mode is below what the LoS model recommends (ibid).

The method proposed here by Beukes & Zuidgeest (2010), and developed further in the subsequent papers noted above, seeks to reconcile the access and mobility functions of streets by providing a fuller picture of who roads serve, and how, than is usually afforded by road engineering practice in South Africa. In support of this claim, Beukes, Vanderschuren & Zuidgeest provide a description of this practice in South Africa, at a time when (automobile) Level of Service remains paramount in road planning. Of relevance to the study area, in which walking and cycling occur along the edges of a freeway-like mobility route all day, is the authors' claim that:

> It is often the case that contextual realities dictate a facility's use irrespective of the limitations imposed by the design. It is in these instances that dangerous situations may occur…City authorities in Cape Town found that of the ten roads with the highest recorded number of pedestrian fatalities, half are officially completely restricted to pedestrians, and the remainder are primarily vehicle mobility routes, with limited access allowed for pedestrians…The (unwanted) pedestrian activity along these routes demonstrates the impact of contextual realities manifested as travel needs despite a lack of infrastructure.
>
> (Beukes, Vanderschuren & Zuidgeest, 2011:453)

The authors (particularly Beukes & Zuidgeest, 2010) have also argued that the City of Cape Town should shift towards a multimodal transport planning process. As shown in Section 2.2, this viewpoint has been echoed in policy at the local (Transport for Cape Town, 2015), provincial (Western Cape Department of Transport and Public Works, 2010) and national (Vanderschuren et al., 2014) level. However, Beukes & Zuidgeest (2010) preface their study by listing a number of constraints that inhibit such a shift in spite of a favourable policy environment. This includes outdated and fragmented guidelines, a lack of explicit guidance on infrastructure provision for mixed-use roads, and professional liability concerns surrounding deviation from such guidelines (ibid:3).

The Context-Sensitive Multimodal Road Planning approach has been included in this literature survey by virtue of the insights it offers into 'context', broadly construed, and the efforts taken by the authors to describe the context of arterial roads systematically. The main advantage of this approach is its ability to act as a countermeasure against the bias of conventional transport planning towards private motorised transport, and thus to place accessibility functions onto a more equal footing with mobility functions in geometric planning. However, since the approach described in this section does not function as a stand-alone cycling environment assessment tool that is comparable with the others, it has been excluded from further analysis in Table 2-1.

2.8.3 Conclusions

The preceding sections have introduced the concept of level of service, and alternative approaches to the assessment of the cycling environment, described their application to bicycles and the emergence of CEATs, and discussed some strengths and weaknesses of selected BLoS assessment tools and their alternatives. The preceding section also described the criteria determining which of these tools were included in Table 2-1 for use in fieldwork. The following section will introduce the area of study and the context in which research was conducted. A composite list of all the criteria featuring in the CEATs in Table 2-1 will be prepared as a means of comparing criteria deemed important by the scholars in this chapter, with the lived experience of cyclists in the study area.

Table 2-1: List of CEATs selected for further analysis

Year	Assessment Tool Title	Short Form	Issuing Authority	Region Assessed or Implemented	Country
1987	Davis Bicycle Safety Index Rating	DAVIS INDEX	N/A	Florida	USA
1997, 2003	Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003.	REAL-TIME PERCEPTIONS	N/A	Florida	USA
2006	Guidelines for Assessing Cycling Level of Service (G-CLoS)	WESTERN AUSTRALIA	State of Western Australia	Western Australia	AUS
2010	Highway Capacity Manual (HCM)	USA FEDERAL	Federal Highway Authority	USA	USA
2010	South African Pedestrian Environment Assessment Tool (PEAT)	SOUTH AFRICA PEDESTRIAN	N/A	Tshwane	SA
2014	Victoria Level of Service Audit Tool for Cycling Facilities (CLOSAT)	VICTORIA AUSTRALIA	VicRoads	Victoria	AUS
2014	Cycling Level of Service Assessment Matrix (CLoSM)	LONDON	Transport for London	London	UK
2014	Cycling Route Audit Tool, Wales (CRAT)	WALES	Welsh Government	Wales	UK

20 The authors also incorporated other locational attributes such as property value, vulnerable road users, income/education levels, heritage sites, and wetlands and ecologically important sites into a Spatial Multiple Criteria Evaluation that complemented land use and density.

Table 2-3: Composite CEAT Criteria Tables

A: Link Criteria

LINK

CEAT CRITERIA → (group)	Criterion	UNIT →	MENTIONED IN FOCUS GROUPS → (2016)	USA – Davis Bicycle Safety Index Rating (1987)	USA – Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003. (1997, 2003)	AUS – Guidelines for Assessing Cycling Level of Service (on-road) (2006)	USA – Highway Capacity Manual (2010)	SA – South African Pedestrian Assessment Tooll (2010)	AUS – Victoria Level of Service Audit Tool for Cycling Facilities (2014)	UK – Cycling Level of Service Assessment Matrix (2014)	UK – Cycling Route Audit Tool, Wales (2014)	TOTAL INSTANCES IN ALL CEATs
	POSTED SPEED LIMIT	(km/h)	1			1						
BICYCLE INFRA-STRUCTURE	PRESENCE OF PHYSICALLY SEGREGATED CYCLE LANE	Y/N	1						1		1	2
BICYCLE INFRA-STRUCTURE	DESIGNATED QUIETWAY/BIKE BOULEVARD	Y/N	1						1			1
BICYCLE INFRA-STRUCTURE	CAR PARKING FORMS BARRIER TO PROTECT CYCLE LANE	Y/N							1			1
BICYCLE INFRA-STRUCTURE	CLEARANCE TO OBSTRUCTION IN BIKE LANE	Y/N							1			1
BICYCLE INFRA-STRUCTURE	BOLLARD IN CENTRE OF BICYCLE LANE	Y/N	1						1			1
BICYCLE INFRA-STRUCTURE	PRESENCE OF BICYCLE PARKING	Y/N	1							1	1	2
BICYCLE INFRA-STRUCTURE	SUFFICIENT WAYFINDING SIGNAGE - SYSTEM NAVIGABLE WITHOUT MAPS	Y/N								1	1	2
BICYCLE INFRA-STRUCTURE	STREET-SIDE BIKE LANE ADJACENT TO CAR PARKING	Y/N	1						1	1	1	3
BICYCLE INFRA-STRUCTURE	WIDTH OF BICYCLE LANE	(m)	1				1		1	1	1	4
BICYCLE INFRA-STRUCTURE	BICYCLE FACILITY LAYOUT ABLE TO BE ADAPTED, INCLUDING TO MAINTAIN QUALITY DURING ROADWORKS	Y/N	1							1		1
BICYCLE INFRA-STRUCTURE	IS FACILITY ABLE TO EXPAND FOR FUTURE GROWTH?	Y/N								1		1
ON-STREET PARKING	PRESENT AS POSITIVE FACTOR	Y/N						1				1
ON-STREET PARKING	PRESENT	Y/N	1						1	1		2
ON-STREET PARKING	PARALLEL	Y/N		1								1
ON-STREET PARKING	OCCUPANCY (%)	%			1		1					2
ON-STREET PARKING	ANGLED	Y/N		1								1
ON-STREET PARKING	(PEAK-HOUR) RESTRICTIONS	Y/N				1		1				2
MOTOR TRAFFIC	POSTED SPEED LIMIT	(km/h)	1			1						1
MOTOR TRAFFIC	PERCENTAGE OF HEAVY VEHICLES	%	1		1	1	1			1	1	5
MOTOR TRAFFIC	AVERAGE DAILY TRAFFIC	veh./day	1	1		1				1	1	4
MOTOR TRAFFIC	MOTORISED VEHICLE RUNNING SPEED	km/h	1		1	1	1		1	1	1	6
MOTOR TRAFFIC	POSTED SPEED LIMIT	km/h	1	1	1	1				1		4
TRAFFIC DEMAND VOLUMES	OVERALL	veh./ hour	1			1						1
TRAFFIC DEMAND VOLUMES	LEFT-TURNING LANE	veh./ hour	1	1								1
TRAFFIC DEMAND VOLUMES	CENTRE TURN LANE	veh./ hour	1	1								1
TRAFFIC DEMAND VOLUMES	THROUGH LANE	veh./ hour	1		1		1					2
TRAFFIC DEMAND VOLUMES	RIGHT-TURNING LANE	veh./ hour	1	1								1
	PRESENCE OF ROADSIDE 'EVASION SPACE' (BUFFER), ABSENCE OF PHYSICAL BARRIERS SUCH AS GUARDRAILS OR BUILDOUTS	Y/N									1	1
	ARE SIDE-ROAD JUNCTIONS FREQUENT OR UNTREATED?	Y/N								1	1	2
LINK GEOMETRY	PINCH POINTS/LANE NARROWING	Y/N	1							1		1
LINK GEOMETRY	CROSS-STREET WIDTH	(m)										0
LINK GEOMETRY	WIDTH OF UNPAVED ROADSIDE BUFFER	m	1					1				1
LINK GEOMETRY	PRESENCE OF PAVED SHOULDER	Y/N	1	1						1		2
LINK GEOMETRY	WIDTH OF PAVED ROAD SHOULDER	(m)	1		1		1		1	1		4
LINK GEOMETRY	RAISED MEDIAN	Y/N		1								1
LINK GEOMETRY	RESTRICTED SIGHT DISTANCE	Y/N	1	1						1		2
LINK GEOMETRY	FREQUENT CURVES	Y/N										0
LINK GEOMETRY	MODERATE SLOPES	Y/N		1				1	1	1	1	5
LINK GEOMETRY	STEEP SLOPES	Y/N		1				1	1	1	1	5
LINK GEOMETRY	WIDTH OF OUTSIDE THROUGH LANE	(m)	1	1	1		1			1		4
LINK GEOMETRY	NO. OF THROUGH LANES	no.		1			1					2
PAVEMENT CONDITION	OVERALL SCORE	Y/N	1		1		1		1	1	1	5
PAVEMENT CONDITION	PRESENCE OF DEBRIS/IRONWORKS	Y/N	1					1		1	1	3
PAVEMENT CONDITION	PRESENCE OF (LEGIBLE) ROAD MARKINGS	Y/N	1					1	1		1	3
PAVEMENT CONDITION	(BIKE LANE SURFACING) GRAVEL OR TIMBER DECKING	Y/N	1						1			1
PAVEMENT CONDITION	CRACKING	Y/N		1			1					2
PAVEMENT CONDITION	PATCHING	Y/N		1			1					2
PAVEMENT CONDITION	WEATHERING	Y/N	1	1								1
PAVEMENT CONDITION	POTHOLES	Y/N	1	1			1	1			1	4
PAVEMENT CONDITION	ROUGH ROAD EDGE	Y/N	1	1								1
PAVEMENT CONDITION	KERB AND GUTTER	Y/N	1	1								1
PAVEMENT CONDITION	ROUGH RAILROAD CROSSING	Y/N		1								1
PAVEMENT CONDITION	DRAINAGE GRATES, SUNKEN COVERS OR GULLIES	Y/N		1						1	1	3
PUBLIC TRANS-PORT INFRA-STRUCTURE	TYPE OF PUBLIC TRANSPORT - MBT/BUS	TYPE	1									0
PUBLIC TRANS-PORT INFRA-STRUCTURE	MBT/BUS LANE PRESENT	Y/N	1						1			1
PUBLIC TRANS-PORT INFRA-STRUCTURE	INTERMODAL TRANSFERS SUPPORTED?	Y/N	1							1		1
PUBLIC TRANS-PORT INFRA-STRUCTURE	PRESENT	Y/N	1					1				1
STREET AMEN-ITIES	SHADE	Y/N										0
STREET AMEN-ITIES	SEATING	Y/N										0
STREET AMEN-ITIES	SIDEWALK OBSTRUCTIONS	Y/N	1									0
BUILT ENVIRON-MENT	ACTIVE FRONTAGES	Y/N	1									0
BUILT ENVIRON-MENT	WIDTH OF STREET FRONTAGE	(m)										0
BUILT ENVIRON-MENT	NUMEROUS DRIVEWAYS	Y/N	1	1	1				1			3
BUILT ENVIRON-MENT	SETBACK OF BUILDING LINE FROM STREET	(m)	1									0
BUILT ENVIRON-MENT	LANDSCAPING	Y/N										0
LAND USE PLAN-NING	INDUSTRIAL LAND USE	Y/N	1	1			1					2
LAND USE PLAN-NING	COMMERCIAL LAND USE	Y/N	1	1								1
LAND USE PLAN-NING	TRIP GENERATION INTENSITY OF ADJOINING LAND USE	trips/day			1							1

B: Sidewalk and Verge Criteria

SIDE-WALK AND VERGE

CEAT CRITERIA → (group)	Criterion	UNIT →	MENTIONED IN FOCUS GROUPS → (2016)	USA – Davis Bicycle Safety Index Rating (1987)	USA – Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003. (1997, 2003)	AUS – Guidelines for Assessing Cycling Level of Service (on-road) (2006)	USA – Highway Capacity Manual (2010)	SA – South African Pedestrian Assessment Tooll (2010)	AUS – Victoria Level of Service Audit Tool for Cycling Facilities (2014)	UK – Cycling Level of Service Assessment Matrix (2014)	UK – Cycling Route Audit Tool, Wales (2014)	TOTAL INSTANCES IN ALL CEATs
PEDESTRIAN SIGNALS	ZEBRA CROSSING	Y/N	1					1				1
PEDESTRIAN SIGNALS	PEDESTRIAN CROSSING	Y/N	1					1				1
PEDESTRIAN SIGNALS	FOOTBRIDGE	Y/N						1				1
PEDESTRIAN SIGNALS	SUBWAY	Y/N						1				1
PEDESTRIAN SIGNALS	PEDESTRIAN CROSSING SIGNAL	Y/N	1					1				1
SIGNAGE	FOR PEDESTRIANS	Y/N	1					1				1
SIGNAGE	FOR DRIVERS, REGARDING PEDESTRIANS	Y/N	1					1				1
TRAFFIC CALMING	CIRCLE	Y/N	1					1				1
TRAFFIC CALMING	SPEED BUMPS AS NEGATIVE	Y/N								1		1
TRAFFIC CALMING	SPEED BUMPS AS POSITIVE	Y/N	1					1		1		2
TRAFFIC CALMING	RUMBLE STRIPS	Y/N	1					1				1
TRAFFIC CALMING	STOP STREET	Y/N	1					1				1
TRAFFIC CALMING	TRAFFIC LIGHT	Y/N	1					1				1
TRAFFIC CALMING	SLIPSTREAM	Y/N						1				1
TRAFFIC CALMING	ROAD NARROWING	Y/N	1					1				1
SIDEWALK MATERIAL	CONTINUOUS CONCRETE, CONCRETE SLABS, PAVING BRICKS, GRAVEL, TAR, GRASS or SAND	TYPE	1					1				1
SIDEWALK CONDITION	SMOOTH AND LEVEL, CRACKS, HOLES, BREAKAGE or ROCKY	TYPE	1					1				1
OBSTRUCTIONS ON SIDEWALK	NONE, TREES, SIGNS, BINS, RUBBLE OR RUBBISH, CARS, MACHINERY OR EQUIPMENT, ELECTRICITY BOX, TRAVELLING ADVERT, TAXI or DRIVEWAY CUTS	TYPE	1					1				1
SIDE-WALK KERB TYPE	TRAVERSABLE, BARRIER, BARRIER WITH DEPRESSIONS, ROUNDED, GUTTER KERBS or DROP OFF PRESENT	TYPE	1					1				1
SIDEWALK	DISTANCE FROM ROAD EDGE	(m)	1					1				1
SIDEWALK	DOES CYCLING PROVISION LESSEN LEVEL OF SERVICE FOR PEDESTRIANS?	Y/N	1							1		1
SIDEWALK	SIDEWALK SHARED BETWEEN CYCLISTS AND PEDESTRIANS	Y/N	1								1	1
SIDEWALK	UNDER REPAIR	Y/N	1					1				1
SIDEWALK	PRESENT	Y/N	1					1				1
SIDEWALK	HAS KERBS?	Y/N	1				1					1
WALLS OR FENCES	OBSTRUCTING MOVEMENT	Y/N	1					1				1
WALLS OR FENCES	OBSTRUCTING VISIBILITY	Y/N	1					1				1
TREES, HEDGES OR BUSHES	PRESENT	Y/N	1					1		1		2
TREES, HEDGES OR BUSHES	OBSCURING VISIBILITY	Y/N	1					1				1
PUBLIC SEATING	PRESENT	Y/N						1				1
PUBLIC SEATING	OBSTRUCTING MOVEMENT	Y/N						1				1
CONSTRUCTION	ROAD CONSTRUCTIONS	Y/N	1					1				1
CONSTRUCTION	ROADSIDE CONSTRUCTION	Y/N	1					1				1
LIGHTING	STREET LIGHTING PRESENT	Y/N	1					1	1	1	1	4
LIGHTING	PEDESTRIAN LIGHTING PRESENT	Y/N	1					1		1		2
NOISE	NOISE LEVEL FROM RECOMMENDED RIDING RANGE	DB								1		1
AIR QUALITY	PM10 AND NOX VALUES	PPM								1		1
SAFETY	PRESENCE OF 'AMBUSH SPOTS'	Y/N	1							1		1
SAFETY	RISK/FEAR OF CRIME	Y/N	1							1		1
SURVEILLANCE	HOUSE FRONTS	Y/N	1					1				1
SURVEILLANCE	SHOP FRONTS	Y/N	1					1				1
SURVEILLANCE	SECURITY CAMERAS	Y/N	1					1				1
SURVEILLANCE	SECURITY GUARDS	Y/N	1					1				1
SURVEILLANCE	PETROL STATIONS	Y/N	1					1				1
SURVEILLANCE	RESTAURANTS	Y/N						1				1
SURVEILLANCE	IS THERE ACTIVITY ON THE ROUTE THROUGHOUT THE DAY?	Y/N	1							1		1
SURVEILLANCE	MINIMISE STREET CLUTTER	Y/N	1							1		1
SURVEILLANCE	ANY SURVEILLANCE	Y/N	1					1		1	1	3
OTHER	GRAFFITI PRESENT	Y/N						1				1
OTHER	LITTER PRESENT	Y/N						1				1
OTHER	ABANDONED BUILDINGS	Y/N	1					1				1
OTHER	OPEN SPACE OR EMPTY LOTS	Y/N						1				1
OTHER	PRESENCE OF HAWKERS	Y/N						1				1
OTHER	PRESENCE OF BEGGARS	Y/N						1				1

Notes: Of particular interest in the tables above is the shift from earlier CEATs, with their emphasis on automobile infrastructure, to later CEATs, which measure a wide variety of bicycle facilities, and include optimistic measures such as the criterion 'Does bicycle facility plan for future growth?'. At left, the South African PEAT dominates criteria relating to the sidewalk - this is unsurprising, as it is designed to assess the pedestrian experience. However, the fact that 'presence of beggars/hawkers' produce negative scores may reflect a very specific approach to assessing the quality of a city in the global South. It is noteworthy that the newest CEATs, designed for London and Wales, also include a wide variety of measures of the sidewalk environment. The London CEAT is also the only tool to include specific measures for pollution.

C: Intersection Criteria

COUNTRY ↓	CEAT CRITERIA → / CYCLING ENVIRONMENT ASSESSMENT TOOLS ↓	YEAR ↓	INTERSECTION: BICYCLE INFRA				MOTOR TRAFFIC		MOT. VEH. SPEED	TRAFFIC DEMAND VOLUMES					OBSERVED ROAD-USER BEHAVIOUR					PARKING	INTER-SECTION GEO-METRY											SIGNALS							KERBS	
			WIDTH OF BICYCLE LANE	EARLY START FOR CYCLISTS FROM SIGNAL	INTERSECTION DEPARTURE LANE (7)	ADVANCE STOP BOX/STORAGE BOX	PERCENTAGE OF HEAVY VEHICLES	POSTED SPEED LIMIT	OVERALL TRAFFIC SPEED (INCLUDING MOTOR VEHICLE RUNNING SPEED)	OVERALL VOLUME	LEFT-TURNING LANE	THROUGH LANE	RIGHT-TURNING LANE	CROSS-STREET VOLUME	OVERTAKING RIGHT-TURNING MOTORISTS	RIGHT-TURN-ON-RED MOTORISTS FROM SIDE STREETS (N/A to SA)	OVERTAKING THROUGH MOTORISTS	LEFT-TURNING MOTORISTS FROM OPPOSING APPROACH	DOES HIGHWAY DESIGN ENCOURAGE CIVILISED BEHAVIOUR (NEGOTIATION AND FORGIVENESS)?	ON-STREET PARKING OCCUPANCY	PRINCIPAL CONFLICTING CYCLIST/MOTORIST TRAFFIC STREAMS SEPARATED	NO. OF LANES APPROACHING INTERSECTION	CROSS-STREET WIDTH	WIDTH OF PAVED ROAD SHOULDER	WIDTH OF (OUTSIDE) THROUGH LANE	RESTRICTED SIGHT DISTANCE	PRESENCE OF TURNING LANES	NO RIGHT TURN LANE	DUAL RIGHT TURN LANE	LEFT-TURN LANE	NO. OF THROUGH LANES	PRESENCE OF SIGNALS	LEFT-TURN ARROW	PERMISSIVE RIGHT-TURN ARROW	BICYCLE-ACTUATED SIGNAL	TRAFFIC-ACTUATED SIGNAL	INSUFFICIENT CLEARANCE INTERVAL	IF UNSIGNALISED, DELAY	PRESENT	SUBSTANDARD KERB RADII
	UNIT →		(m)	Y/N			%	km/h	km/h	veh./ hour					Y/N					%	Y/N	Y/N	(m)	(m)	(m)	Y/N					no.	Y/N								
	MENTIONED IN FOCUS GROUPS →	2016					1	1	1	1	1	1	1	1			1	1	1	1	1	1		1	1	1					1	1								
USA	Davis Bicycle Safety Index Rating	1987										1		1												1		1	1	1	1		1	1		1	1			1
USA	Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003.	1997, 2003							1	1					1	1	1	1					1		1					1							1	1		
AUS	Guidelines for Assessing Cycling Level of Service (on-road)	2006							1	1																														
USA	Highway Capacity Manual	2010	1								1	1	1							1			1	1	1						1								1	
SA	South African Pedestrian Assessment Tooll	2010																				1																		
AUS	Victoria Level of Service Audit Tool for Cycling Facilities	2014		1	1	1			1		1																				1				1			1		
UK	Cycling Level of Service Assessment Matrix	2014									1		1	1					1		1		1		1					1		1								
UK	Cycling Route Audit Tool, Wales	2014							1												1																			
	TOTAL INSTANCES IN ALL CEATs		1	1	1	1	0	0	4	2	3	2	2	2	1	1	1	1	1	1	2	1	3	1	3	1	0	1	1	3	3	1	1	1	1	1	2	2	1	1

D: Network Criteria

COUNTRY ↓	CEAT CRITERIA → / CYCLING ENVIRONMENT ASSESSMENT TOOLS ↓	YEAR ↓	NET-WORK: COHESION			DIRECTNESS				
			CYCLISTS ABLE TO JOIN/LEAVE ROUTE SAFELY	NETWORK IS CONTINUOUS, INCLUDING THROUGH INTERSECTIONS	MESH' OF CYCLABLE STREETS FINER THAN 250m	IS VALUE OF TIME (VOT) FOR CYCLISTS EQUAL TO THAT OF MOTORISTS?	DEVIATION AGAINST STRAIGHT LINE	FREQUENCY OF STOPS OR YIELDS REQUIRED	ARE CYCLISTS REQUIRED TO COME TO A STOP AT INTERSECTIONS? (BYPASS, YIELD)	CAN CYCLISTS TRAVEL MOSTLY AT OWN SPEED ON LINKS?
	UNIT →		Y/N		m	Y/N	%	per km	Y/N	Y/N
	MENTIONED IN FOCUS GROUPS →	2016	1	1	1	1	1	1		1
USA	Davis Bicycle Safety Index Rating	1987								
USA	Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003.	1997, 2003								
AUS	Guidelines for Assessing Cycling Level of Service (on-road)	2006								
USA	Highway Capacity Manual	2010								
SA	South African Pedestrian Assessment Tooll	2010								
AUS	Victoria Level of Service Audit Tool for Cycling Facilities	2014		1			1			
UK	Cycling Level of Service Assessment Matrix	2014	1	1	1	1	1		1	1
UK	Cycling Route Audit Tool, Wales	2014	1	1	1		1	1	1	1
	TOTAL INSTANCES IN ALL CEATs		2	3	2	1	3	1	2	2

Notes: Intersection criteria, above, make an interesting comparison with Tables 2-3 A, B and D, since its criteria feature far more evenly across the CEATs. As in previous tables, later CEATs assess bicycle facilities more explicitly. In 'Net-work' criteria, at left, it is clear that the newest CEATs measure net-work-level effects in some detail, while earlier CEATs disregarded these issues, in favour of a street-by-street perspective. This may reflect an evolution in CEATs, from a tool for professionals to one that is intended to be undertstood by the general public. Evidence for this may be found in the explicit way that Transport for London states that it aims to conduct detailed and critical discussion with civil society and cycling advocates, inter alia through the promotion of tools such as the Matrix (Transport for London, 2014:53).

Chapter 3. Unpacking the Methods used to Conduct Research on Cycling Environment Assessment Tools

3.1 Introduction

This chapter presents the research methods and techniques employed in the study. A desktop study was carried out to collect secondary data including sources such as print and online media, while primary data was gathered tin the form of structured interviews with various planning professionals and officials, and semi-structured interviews and focus groups with research participants. The primary objective of this chapter is to present the manner in which data were obtained, collated and analysed, and explain why the research methods chosen were the most appropriate to the aims of the study. This chapter also introduces the urban form and geography of study area in historical perspective. Lastly, the chapter presents some of the challenges experienced in collecting this data.

3.2 Rationale for the Approach

The approach employed in this study was informed by two aims. Firstly, it entailed a deliberate attempt to connect local cycling planning with international practice through a contextual evaluation of tools for the assessment of the cycling environment drawn from outside South Africa. Secondly, this study aimed to provide recommendations towards a cycling environment assessment tool (CEAT) that would be appropriate for the conditions prevailing in the study area, and potentially further afield. These aims were best served by the case study method, which allowed for an examination of cycling practice in the study area as a whole, as well as through the lenses of three sub-cases. The results of this examination, in which cycling was approached as a complex practice with many determinants, were then assessed against a composite list of the criteria used in the CEATs sampled.

Secondly, the study aimed to provide recommendations towards a Cycling Environment Assessment Tool that is adapted to the context of the study area. Fulfilling this aim required a critical analysis of the degree to which the determinants of cycling assessed in the various CEATs do in fact correspond with the determinants of cycling practice in the study area. This in turn required a qualitative study of cycling as practiced by study participants residing in the study area. However, the potential group of study participants residing in the study area presented a sharply divergent socioeconomic profile. This is elaborated below through sketching various participant profiles. These will be discussed further in Section 3.8.

After preliminary open-ended interviews conducted in preparation for the study, semi-structured interviews and focus groups were preferred to structured questionnaires for a number of reasons. While this choice rendered the processing of findings more challenging, the wide range of diversity on a number of socioeconomic variables meant that structured interviews could limit the range of responses. This included differences in education, income levels, and language proficiency. Semi-structured interviews and focus groups were conducted with the support of a professional isiXhosa interpreter, and with the author and Ocean View community liaison for interviews in Afrikaans and English. Given the limited scope of literature on commuter cycling in South Africa, I deemed it preferable to privilege an open-ended and exploratory process rather than working to a predetermined format. Semi-structured interviews are well-suited to this approach, although they do bring their own challenges. Some of the challenges inherent in this technique will be discussed in this chapter.

The research questions set out in section cannot be answered without consideration of the embedded role of cycling within a range of mobility practices, as experienced by participants. For this reason, personal semi-structured interviews were conducted, and focus groups were restricted to a maximum of seven participants. Participants were selected in consultation with the proprietor of the BEC in the case of Ocean View and Masiphumelele, and with the proprietor of Regal Cycles in the case of Fish Hoek. Interviews and focus groups were conducted with the aid of cartographic and topographic materials developed by me, depicting the study area to a degree of detail that would allow participants to indicate their route and other mobility choices using familiar landmarks. The small size of the groups facilitated the depth of discussion required to engage with the content of the research questions, while also allowing for new avenues of enquiry and conjecture to emerge on the part of the participants.

Figure 10: Masiphumelele BEC. The proprietor is affixing flyers for this study to the doors.

Figure 9: Ocean View's cycling club, organised by the local BEC proprietor

3.3 Rationale for the Choice of Study Partner

3.3.1 The Bicycle Empowerment Network and Bicycle Empowerment Centres

In Cape Town, the mobility of low-income residents is constrained by a number of factors, including journey characteristics and spatial, socio-demographic, and socio-psychological characteristics (Boulle, 2013). The Bicycle Empowerment Network is a charity organisation that distributes bicycles to low-income communities as a means of providing reliable and low-cost mobility to both scholars and adults. One of the BEN's strategies has been to establish Bicycle Empowerment Centres, which function as small entrepreneurial bicycle repair shops, where bicycle parts are also sold. BECs create livelihoods for local bicycle technicians, while also ensuring that local residents' bicycles can be affordably maintained within the community. BEN's establishments in Masiphumelele and Ocean View date back to 2000 and 2009 respectively. In Masiphumelele, the BEC is known as Masi Bike Shop, located at 1764 Pokela Street, Masiphumelele. The proprietor, Mr Solomon (Morgan) Chikumba, has run the shop since its founding in June 2000 (BEN, 2016). In Ocean View, the BEC is known as Future Legends of Africa and is hosted at Ocean View High School. The proprietor, Mr James Esterhuizen, has run the shop since its founding in April 2009 (ibid). The choice of an embedded community partner to facilitate the primary research phase of the study carries with it the risk that perceptions and attitudes towards the community partner could influence or frame participants' responses to the study. In an effort to mitigate this, isiXhosa interpreters from outside the community, were asked to explain to research participants that the research being conducted was independent of BEN, and the BECs and their proprietors.

3.3.2 Regal Cycles

The choice of Regal Cycles as a venue for engaging with a middle-income, minority cycling group within the study area, was motivated by its geographically central location within the study area's largest settlement - in the Fish Hoek CBD - as well as its position as the only commercial bicycle shop within the study area. Securing the cooperation of Regal Cycles also made it possible to advertise the study within their premises, enabling a large number of local cyclists to be reached.

3.4 Data Gathering

3.4.1 Preliminary Interviews

Preliminary meetings were held in order to gather information about the current state of cycling planning within the study area and within the City of Cape Town in general, to a greater extent than could be determined from published sources. Preliminary meetings with the Non-Motorised Transport section of Transport for Cape Town - the City of Cape Town's transport authority with responsibility for infrastructure planning - were held in June and September 2016. At these meetings, open-ended discussions were held with Mr Teuns Kok and Ms Nicky Sasman, two senior transport planning officials. One of the key findings from these interviews was that the City possesses little contextual data on commuter cycling, and even less qualitative data on the cycling modes of low-income commuters. It was acknowledged that, in the latter area, BEN has been an important source of information for the City in the past, and that BECs constituted the only sustained and dedicated source of qualitative and quantitative data on commuter cycling in low-income communities in the city. The trust and familiarity evident between BEN and the City officials was a further argument in favour of situating the low-income qualitative study on BEC premises, as it was determined that this was unlikely to negatively affect the credibility of the data. Further preliminary meetings were held with Gail Jennings - a professional NMT consultant based in Fish Hoek, and long-time resident of the study area.

3.4.2 Semi-Structured Interviews

Semi-structured interviews are a commonly used method in qualitative research that offer a particular advantage over other interview methods in fields where there is little existing research, and in which an overly structured interrogation risks foreclosing hitherto unknown avenues for discussion and disclosure (Longhurst, 2010). Semi-structured interviews in such cases are also informative for useful in formulating establishing general questions for follow-up focus group sessions (Bryman, 2012).
A first round of semi-structured interviews was conducted with the proprietors of both BECs and with the proprietor of Regal Cycles. The primary aim of this round was to gain an account of cycling practice within the area from the perspective of entrepreneurs who were are professionally invested in cycling as a practice. The secondary aims of this round were to derive a list of potential participants the for focus groups. Mr James Esterhuizen, the proprietor of the Ocean View BEC, was generous enough to invite me to accompany him on a practice ride for local children (Figure 9), and take me on several reconnaissance rides around the Corridor. Mr Morgan Chikumba, the proprietor of the Masiphumelele BEC, also gave generously of his time in interviews.

3.4.3 Focus Groups

Focus groups are used extensively in social research, where group conversation and interaction is able to facilitate rich, co-produced knowledge (Bryman, 2012). Their particular advantage in mobility studies lies in the interaction between participants in which the researcher may be decentred, and participants are able to engage with one another directly. The social context of the focus group is familiar, and may more closely resemble the way in which cycling is practiced than would be the case in a one-on-one interview with a researcher from outside the community. The focus group method may be particularly valuable in contexts of pronounced social inequality, such as that of the study area, where the researcher belongs to a social group that is coded in a very marked way as an 'outsider' to some of the social groups residing within the BEC communities. The iterative nature of focus group discussions, where discussion flows in an unstructured or semi-structured way, allows a diversity of views to be captured, and for unanticipated ideas to be introduced (Bryman, 2012). Conversely, the reproduction of social contexts can be a drawback of focus groups where intimate or personal issues are in question; however, since cycling is a public practice, this was not deemed to be a significant constraint on free participation in the research. The focus groups were composed of customers of the BECs and of Regal Cycles, as well as cyclists known to the proprietors. Two focus group meetings were held in each community. Group sizes were limited to a maximum of 10 participants in each. This was firstly due to the constraints of venue size and access to visual and cartographic aids, but also to facilitate lively discussion without rendering any individual participant anonymous. The selection criteria for inclusion in the focus groups were that participants had to be:

- Active cyclists (having used their bicycles as transport at least once within the past month);
- Area cyclists (having travelled outside of the immediate neighbourhood by bicycle within the past month);
- Destination cyclists (having travelled to a defined destination by bicycle for a non-recreational purpose).

The decision to exclude non-cyclists from the study was motivated by the fact that the Bicycle Level of Service concept is a measure of the actual rather than the potential experience of cycling, and thus depends on existing cycling practice rather than latent demand for cycling. Focus group sessions were voice-recorded and transcribed. Maps were used in all but one focus group (due to a logistical challenge), enabling participants to draw their commutes and record their knowledge of the area.

3.4.4 Coding

The evolving nature of an investigation of the type attempted in the study demands that data be generated and analysed iteratively (Bryman, 2012). Open coding of data took place after each event in each of the three investigation stages – preliminary meetings, semi-structured interviews and focus groups (Strauss & Corbin, 1990). Axial coding took place after each of the three phases. Finally, once the three phases had been completed, selective coding took place, allowing for the development of concepts into categories, and the attribution of properties to these categories in Straussian terms (Strauss & Corbin, 1990). The selective coding phase saw codes resolved into the Physical/Non-Physical categories that structure Section 4.5 and 4.6.

3.5 Sampling

As Table 4-6 shows, the total population sample for focus groups was 36 out of a total study area population of 41428 (Census 2011), or 1:1150. This sample is thus not intended to be representative of the experience of all cyclists within the study area, or, by extension, all cyclists within Cape Town or South Africa; rather, it is intended to illustrate such determinants of cycling as relate directly to the built environment within the Kommetjie-Fish Hoek corridor for a group of self-selecting regular commuter cyclists.

3.6 Limitations

The use of a focus group model to explore these determinants with participants has its limitations (Bryman, 2012). Among these limitations is the propensity of certain group members to play a dominant role in the flow of discussion, while others are more reticent. This was managed in several ways. For example, turns were used, so that each participant was given the opportunity to both describe his or her cycling determinants and to illustrate these with the help of the cartographic and visual aids provided. Additional limitations of the focus group setting include group effects such as cultural expectations, polarisation and conformity. Morgan (2000) described the a tendency, whereby information given by an individual in during a focus group session may differ significantly from what

Table 3-4: Data Collection Methods and Number of Participants

Type	Preliminary Meetings	Semi-Structured Interviews	Focus Groups		Community Population (Census 2011 Place and Population)	Community to Group Ratio
No. of Partici-pants	6	6	Fish Hoek	9	Fish Hoek Main Place	1:990
				3	11890	
			Ocean View	10	Ocean View Sub-Place	1:969
				4	13569	
			Masiphumelele	4	Masiphumelel Sub-Place	1:1596
				6	15969	
Total	6	6		36	41428	

that individual discloses in a personal interview, due to cultural and other pressures. The tendency of group members to either conform to views expressed, such that dissent is silent, or, conversely, for the discussion to become polarised, has also been described by Morgan (1997). These limitations were managed by briefing the isiXhosa interpreter on these potentialities.

3.7 Positionality

A further limitation of the research approach is the author's personal experience as a committed cyclist in a car-dependent society. As Golub et al. (2016) have argued, the 'embodied vulnerability' of cycling researchers who are also practitioners can function as an empirical blind spot. However, I argue that my positioning as a fellow cyclist, subjected to some of the same physical risks faced daily by those I interviewed and sought to learn from, can constitute a point of commonality between myself and research participants, particularly those living on far lower incomes, such as the people of Masiphumelele.

3.8 Rationale for the Choice of Study Area

3.8.1 Cape Town's Southern Peninsula

The choice of a study area within metropolitan Cape Town was motivated by a number of factors. Firstly, there has been longstanding support for cycling at both metropolitan and provincial level in the form of successive Non-Motorised Transport (NMT) policies, demonstration projects and pilots, symbolism and marketing, and metro-scale infrastructural investment (Jennings, 2015). Secondly, the city's situation on a mountainous peninsula (see Figure Figure 11) has imposed a high degree of spatial discipline on the study area, which is sandwiched between mountains to the north and south, with the sea to the east and west. Communities here, in the Southern District of Cape Town, are entirely dependent on a small number of road connections and a single rail link (in red) with the rest of the city and country. Thirdly, the study area presents a high degree of social and spatial disparity within a small area. Figure 12 shows the distribution of racial self-identification in the Fish Hoek Valley, according to the 2011 Census (Frith, 2015). In Masiphumelele, which includes areas of both formal and informal settlement, a predominantly Black African population (89.39%) lives at very high density (40 946 persons/km^2). To the west lies Ocean View, a very largely 'Coloured' suburb (91.38%), where densities are high but considerably lower than in Masiphumelele, reflecting somewhat higher average incomes. Occupying much of the rest of the Fish Hoek Valley are the dispersed purple dots signifying 'White' residents, whose expansive settlement pattern suggest much higher average incomes. The Census Main Place 'Fish Hoek' (79.99% White, and nowhere exceeding a density of 3645 persons per km^2) is an example of this type of settlement.

3.8.2 The Kommetjie Road corridor

The striking degree of difference between these communities is connected by Kommetjie Road (in a blue striped line), which is also the only thoroughfare passing East-West through the Valley. This road and the settlements immediately adjacent to it will be referred to as the Kommetjie Road corridor in this study. The Corridor extends from the suburb of Kommetjie in the west to the suburb of Fish Hoek in the east, where it is anchored by Fish Hoek's Central Business District (CBD) and Metrorail railway station. The railway line, which offers job opportunities in both directions (Simon's Town's dockyards, and Cape Town's Southern Suburbs and CBD), is an important connection in light of the paucity of road links between the Corridor and the metro. The following section considers the historical development of the Corridor in order to better understand its present mobility patterns.

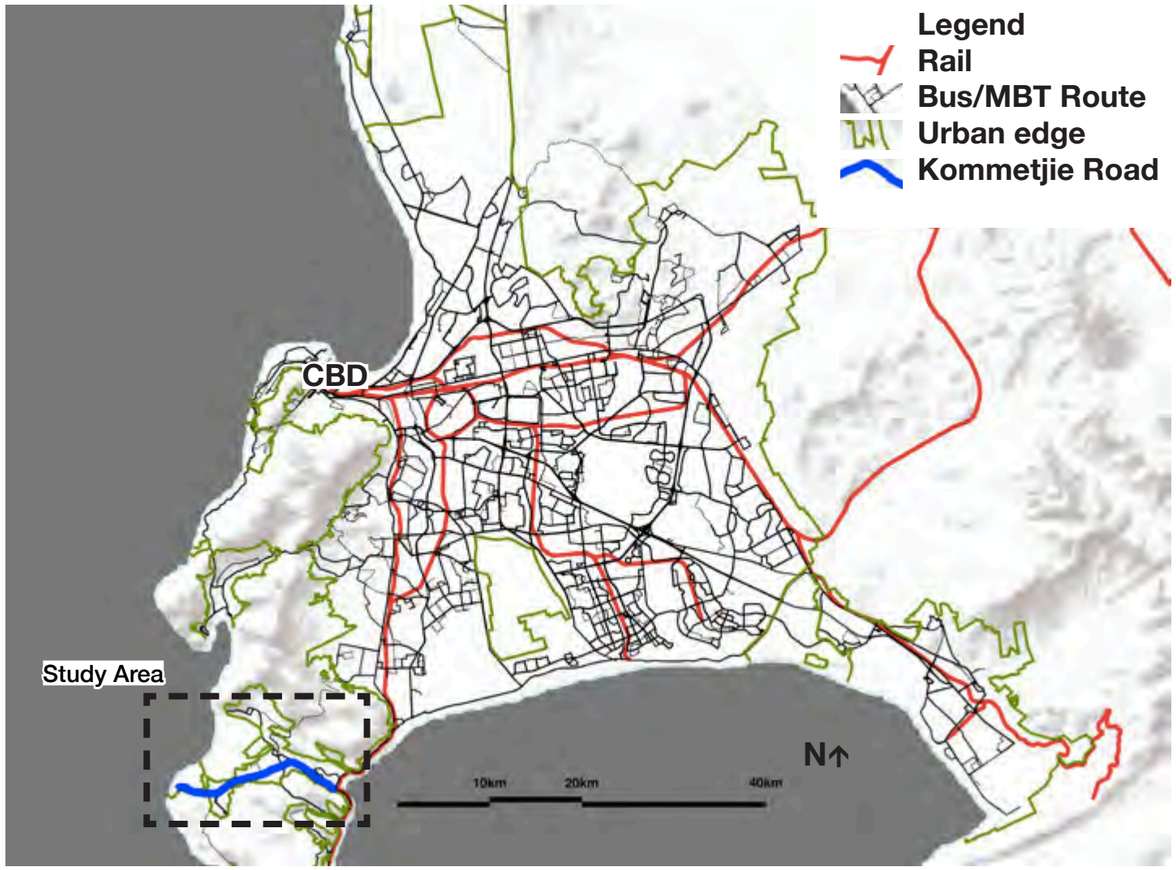
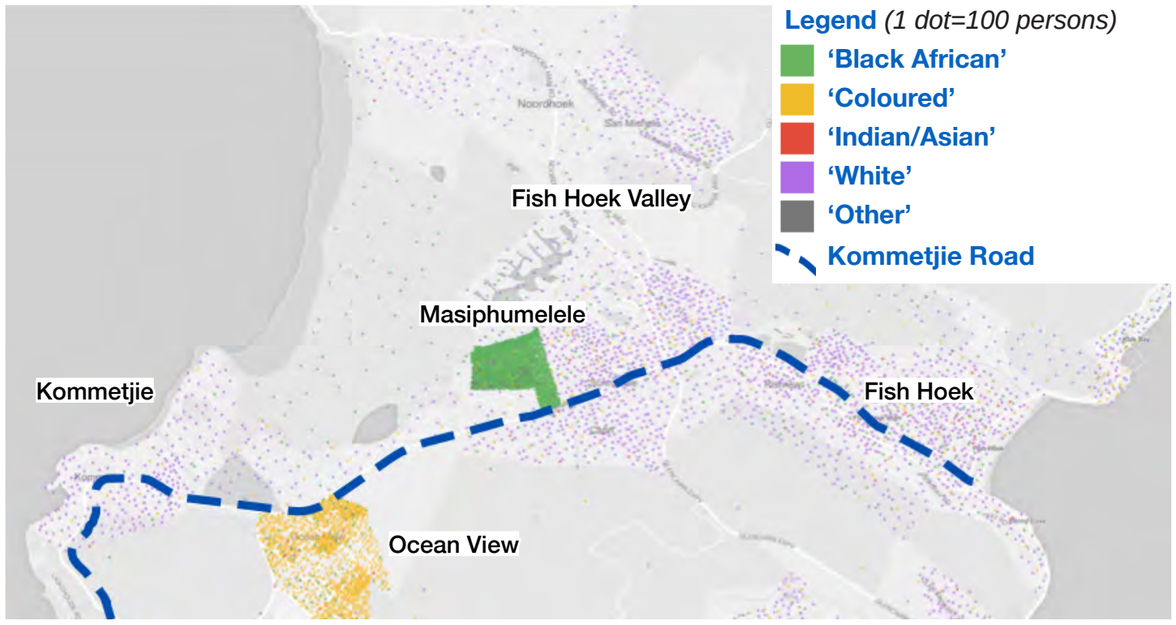


Figure 11: The Kommetjie Road Corridor (in blue) within the City of Cape Town (urban edge outlined in green).

Figure 12: Racial Distribution in Fish Hoek Valley (Frith, 2015)



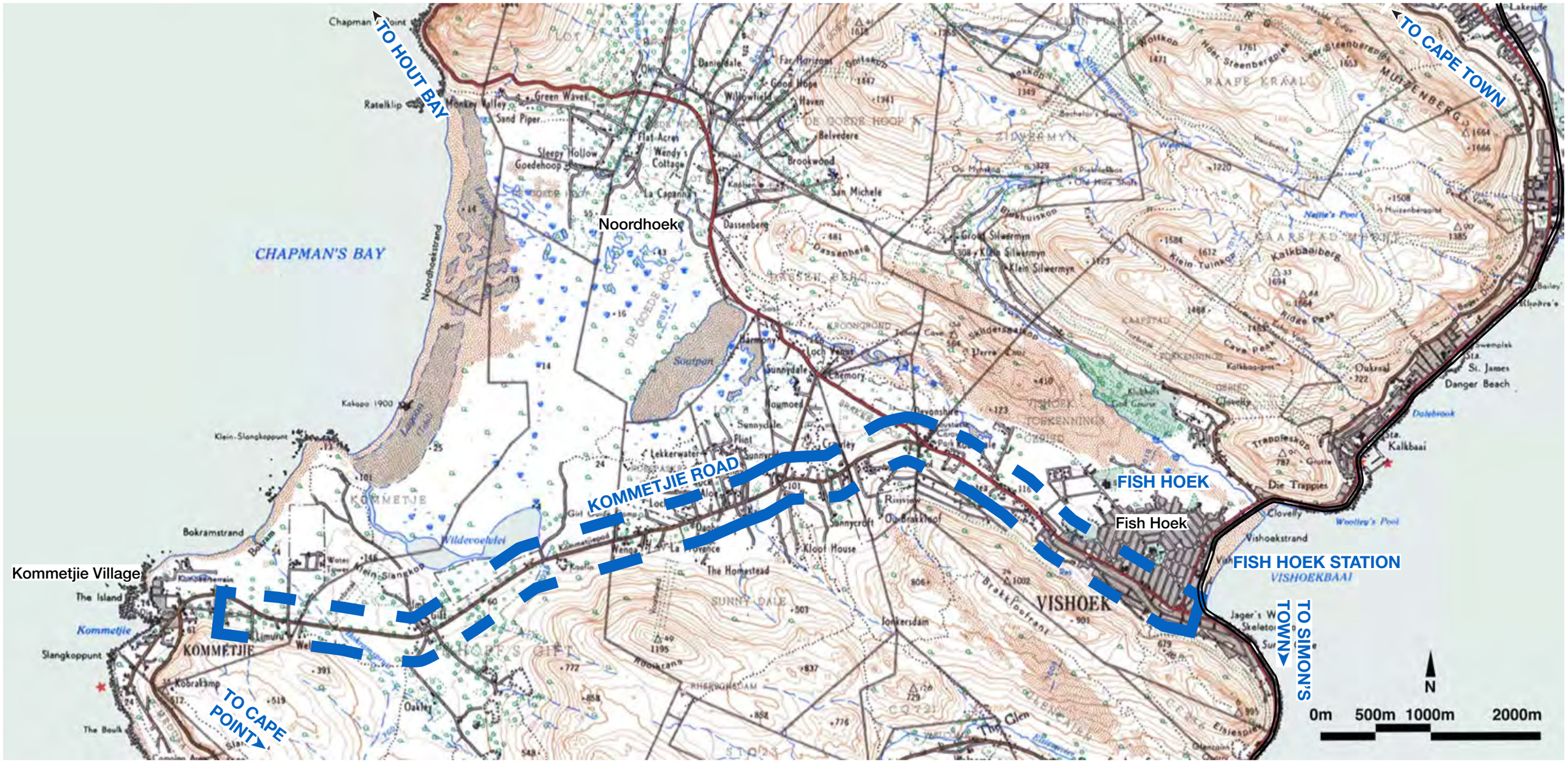


Figure 13: The Fish Hoek Valley, 1960 (Source: Frith, 2016)

3.8.3 The Fish Hoek Valley in 1960

In 1960, movement along the valley was linear, with Kommetjie Road (outlined in blue in Figure 13) and Noordhoek Main Road (leading to Hout Bay at top left) the only arterials. The nucleus of Fish Hoek proper has been established in its characteristic hexagonal layout. Throughout the 20th century, as in the rest of Cape Town, place capital in the Fish Hoek Valley has been strongly indexed to race. Starting in 1918, Fish Hoek was developed from the first as an exclusively white area by means of title deed restrictions (Brodie, 2015). Neighbouring Kalk Bay and Simon's Town, with their employment opportunities in fishing and dockyard work, were far more racially mixed. When these municipalities were declared White Group Areas in 1967, a part of the population classified as 'Coloured' was forcibly removed to the new suburb of Ocean View, established the following year (ibid.). The start of construction at Ocean View, as well as new 'White' suburbs like Capri Village, coincided with the commencement of works on Ou Kaapse Weg and the Glencairn Expressway in 1968[1] (ibid), as shown in Figure 14. The arrival of a major new road link between the middle of the valley and Cape Town enhanced access for motorists, while the new suburbs were each designed with only a single vehicular access point to Kommetjie Road. For the 'Coloured' residents of Ocean View, who had been moved from compact and walkable seaside towns centred around railway stations, this move meant the loss of easy access to the railway and jobs, and imposed a 9.7km journey to the nearest railway station at Fish Hoek. At the same time, racial restrictions on employment made it less likely that these residents would be able to afford increased transport costs. While the residents of Fish Hoek enjoy walkable access to a railway station, mass automobility is already coming to be a feature of (White) South African life, as countrywide motor vehicle ownership would pass the million-vehicle mark in this year (Floor *in* van Eeden, 2012). Further, the particular scenic appeal of Cape Town's Far South had already served as the impetus to the early construction

1 This name, meaning 'Old Cape Road', is a misnomer – no historical road had existed along this route. Its completion therefore presented a new spatial configuration for travel beyond the Valley (Brodie, 2015).

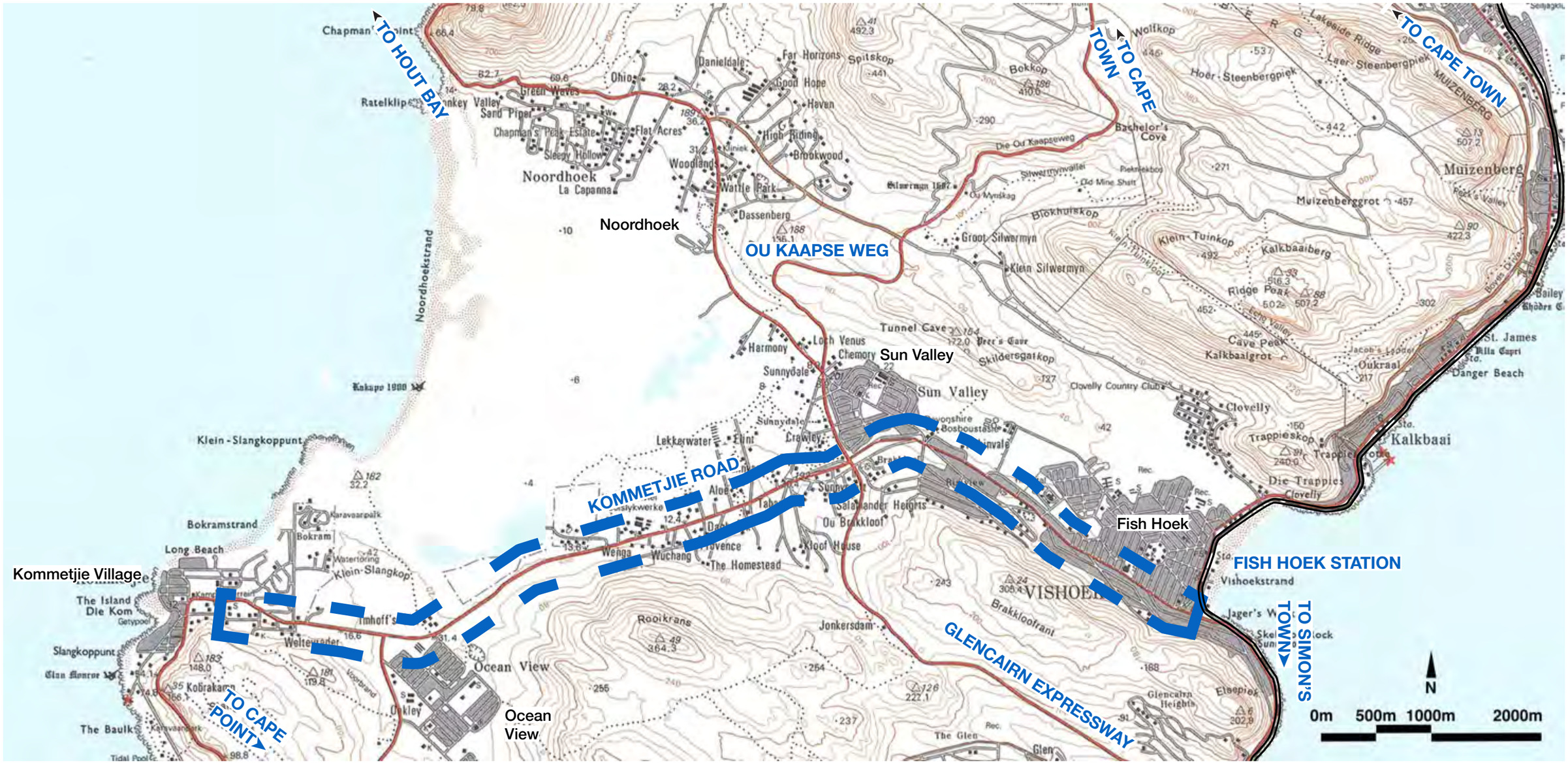


Figure 14: The Fish Hoek Valley, 1980 (Source: Frith, 2016)

of good roads for the nascent domestic and international tourism industry, starting with Chapman's Peak Drive in the 1920s (Johnson and Stuard-Findlay in ibid.). Figure 14 shows the completed Ou Kaapse Weg and the Glencairn Expressway in 1980, as well as a substantially complete Ocean View and major growth in Fish Hoek, extending to the new suburb of Sun Valley. Access to the Valley has been altered by the way in which Ou Kaapse Weg and the Glencairn Expressway allow for North-South movement, bringing people directly from Glencairn to the south over the mountain to the north, and offering direct access to Cape Town's Southern Suburbs. Fish Hoek's older, walkable urban fabric no longer lies in the most easily accessible part of the Valley (due to its proximity to the railway), as mass automobility has by this time become a normalised feature of (white) South African life (Pirie, 1993). In this context, it is noteworthy that the inhabitants of Ocean View, who in 1980 enjoyed limited economic opportunities by law, are also legally restricted to a site far from high-quality public transport and employment, while much open land remains between Ocean View and 'White' Fish Hoek.

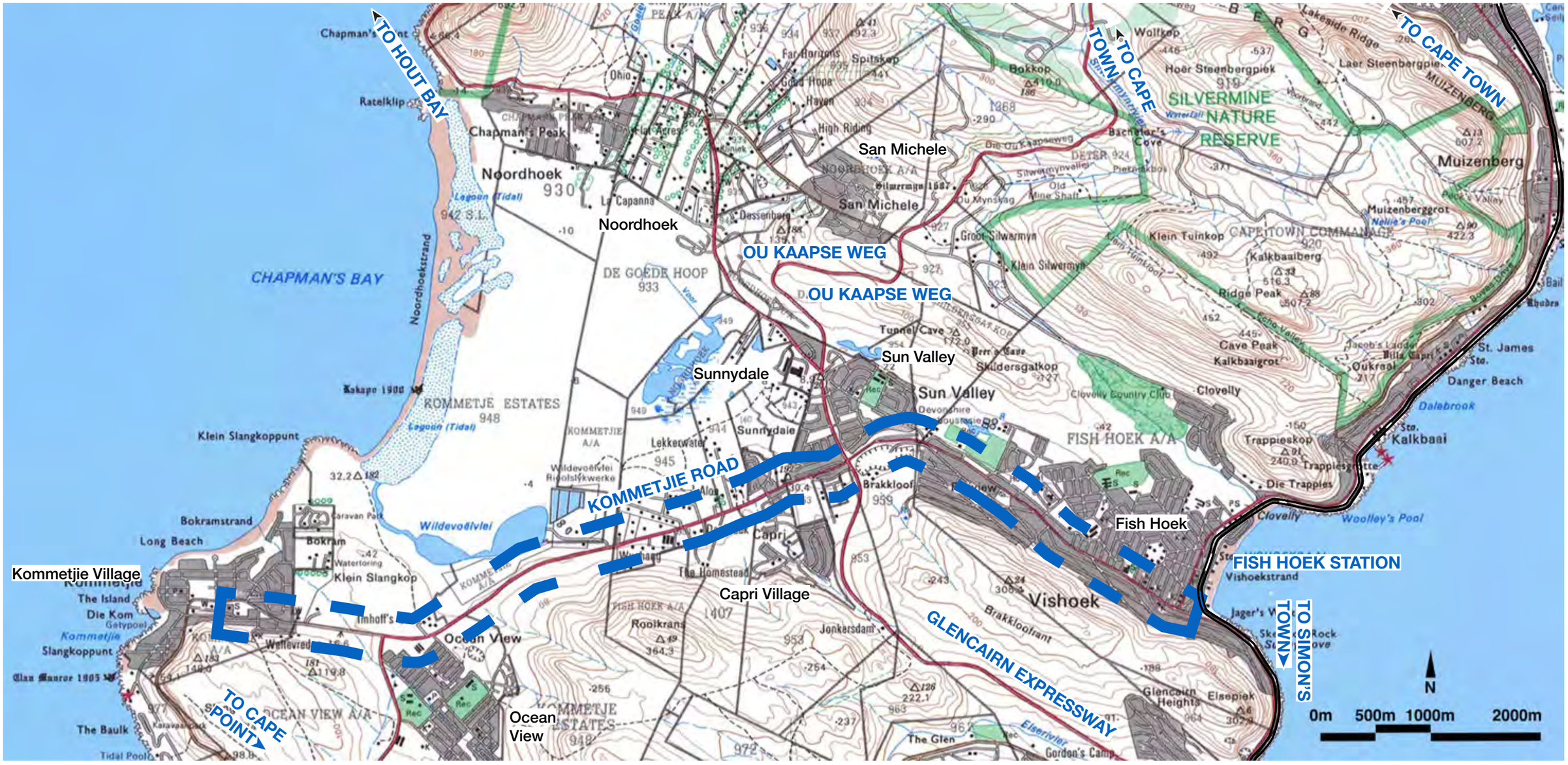


Figure 15: The Fish Hoek Valley, 1990 (Source: Frith, 2016)

Figure 15 shows the Valley in 1990, following considerable expansion to settlements in the preceding decade. What is noteworthy here is that the growth has been largely residential. Car-dependency is built into new suburbs such as San Michele or Capri Village, which have car-centric layouts restricting through-traffic and limiting walkability, and little to no non-residential land uses. This tendency towards decentred growth and suburban sprawl was marked across South African cities at this time, and proceeded in tandem with the deregulation of transport at a national level, leading to the rise of the minibus taxi industry and a freight modal shift from rail to road (Woolf & Joubert, 2013; Stander & Pienaar, 2005). All three of these trends would contribute to a steady increase in motor traffic. At the same time, Apartheid's racial and spatial order was fraying, and would culminate in the repeal of the Group Areas Act in 1991 (Schuermans, 2016). This change would set in motion decades of pent-up population movements, especially to the cities. Figure 16, showing the Valley in 2000, reveals a major manifestation of these changes in Masiphumelele, which was founded as a permanent informal settlement[2] circa 1991. By 2010, its population had been estimated at 38,000 over 0.45km^2 (Masicorp, 2010). This population occupies a central position in the Valley that is more advantageous than that of Ocean View in terms of walkability, since Masiphumelele residents are closer to the job opportunities in the small industrial area at Sunnydale (circled), as well as those that flank the settlement on both sides. In comparison with this spontaneous settlement, the planned neighbourhood of Ocean View remains far from centres of employment.

Although its population has continued to increase between 2000 and the present, settlement in the Valley had at that time already assumed the outlines that it has today[3]. As residents' associations have repeatedly voiced, however, the Valley's major transport infrastructure has not expanded significantly since 1968, while service levels for scheduled buses and trains have fallen (Far South

2 Previous attempts dating back to the 1980s had been opposed by officials, and the settlement removed.
3 For this reason, the most recent Trigonometrical Survey Map for 2010 has been omitted.

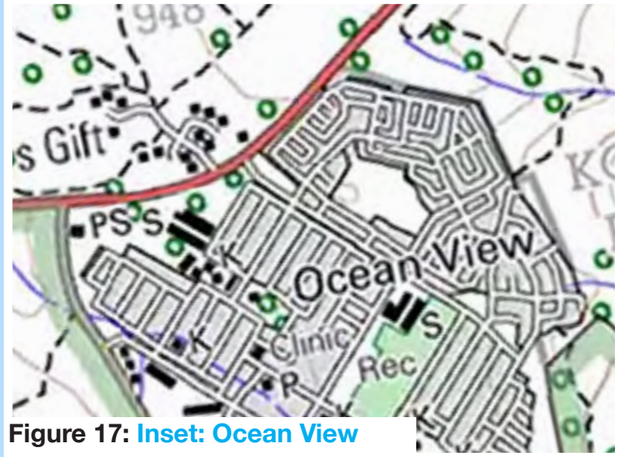


Figure 17: Inset: Ocean View

Figure 18: Inset: Fish Hoek

Figure 16: The Fish Hoek Valley, 2000 (Source: Frith, 2016)

Community Forum, 2015). As will be discussed below, claims that ease of movement in the Valley has been sacrificed in favour of rapid growth remain a source of significant tension between residents and the City of Cape Town, and were also mentioned by focus group participants.

Yet the image below reveals several other spatial elements that proved to be significant influences on how research participants move around by bicycle. Firstly, in neighbourhoods constructed before 1980, such as Kommetjie Village and Fish Hoek proper, there are many connections between the residential street grid and bounding arterial roads. This is well illustrated in two excerpts from this map: at top right, in central Fish Hoek, every street in the oldest part of the settlement meets Kommetjie Road, offering a wide range of choices in how and when to take the arterial. At top left is a section of Ocean View shown to the same scale. Here, only one entrance to Kommetjie Road is provided, and only two to a secondary arterial. There are no retail areas or significant employment centres within walking distance (the nearest large supermarket is at Long Beach Mall, 6.9km away on foot). No major formal public transport infrastructure has been provided either at Ocean View or Masiphumelele, although income levels in both neighbourhoods still price a large number of households out of motorised private transport (Census 2011; Statistics SA, 2016). Apart from the formal taxi and bus rank at Fish Hoek Station, the only other transport interchange in the Valley is at the Long Beach Mall (circled), where a taxi rank operates in a section of the parking area. An analysis of official survey maps dating back half a century thus reveals a trend in the Valley towards a planned dependency on private motorised transport, combined with a concentration of large numbers of captive public transport users (in Ocean View, and especially in Masiphumelele) away from high-quality public transport. Ecological considerations also present a growing constraint on settlement as well as transport infrastructure over this period, as shown by the steady 'encroachment' of green-bordered protected lands (such as Table Mountain National Park) from the 1960s to 2000.

Figure 19: Map of the Kommetjie Road corridor

Legend: Intersections

Intersections with Kommetjie Road

A. Slangkop Road
B. 'Ocean View Intersection' (MIlky Way)
C. 'New Masiphumelele [Masi.] Access' (Abington Road)
D. 'Masi. Access' (Pokela St)
E. 'Masi. Industria' (Lekkerwater Rd)
F. Capri Robots' (Capri Rd/Palm Dr)
G. 'NMT Link to Malls' (Sunnydale Rd)
K. 'Fourway Robots' (Ou Kaapse Weg/Glencairn Expressway).
L. Corsair Dr
M. Riverside Dr
N. 17th Ave.
O. 'Fish Hoek Circle' (Main Rd)

Intersections with Ou Kaapse Weg:

H: Noordhoek Main Rd
I: 'Turnoff to Malls'

Red Circle/Letter indicate Intersection
Black No. indicates total road incidents for 2010-15 (Source: TCT, 2016)
Red No. indicates total involving bicycles for same period

Note: Insets not to scale

TO HOUT BAY

OU KAAPSE WEG - TO CAPE TOWN

Sunnydale

Capri

Sun Valley

Clovelly

Fish Hoek

Kalk Bay

Glencairn

TO MUIZEN-BERG

GLENCAIRN EXPRESSWAY

TO SIMON'S TOWN

TO SIMON'S TOWN

49 H 3

49 I 3

T

30 L 3

284 K 3

G

F 8 1

66 5

32 M 1

39 N 1

T

R

49 O 0

LEGEND

- Kommetjie Road
- Other Arterial Roads
- Other Roads
- Built-Up Areas
- Employment Clusters
- T Taxi Rank
- R Railway Station
- Focus Group
- Community

Figure 19 presents the contemporary Kommetjie Road corridor. Road incident data for 2010-2015 provided by the City of Cape Town (2016) shows traffic incidents in general, and those involving bicycles specifically, for Kommetjie Road and its intersecting roads. Of particular interest, in light of findings in the next chapter, is the very high bicycle accident rate encountered at sites ‘E’ and ‘F’, which lie direclty between Masiphumelele and important transport and employment destinations for its inhabitants. As will be seen in Section 4.6.6, cyclists (and pedestrians) are compelled to use this stretch of arterial road in great numbers due to forced deviations between their trip origins and destinations. This map also shows the great difference in space that the three communities lay claim to, comparing their very different footprints with their respective populations in Table 3-4. The various intersection insets show the variety of Kommetjie Road, which shifts from a single carriageway at Intersection A, where it is only 7m wide, to a 21m-wide, five-lane arterial as it approaches Intersection K, commonly called ‘Fourways’ in the Fish Hoek Valley. Lastly, Kommetjie Road is noteworthy for the deserted nature of its verges, particularly between Kommetjie Vaillage and Ocean View, and between Ocean View and Capri. As the following chapter will show, these long, deserted stretches of unsurveilled roadway, combined with lengthy barriers (such as periimeter walls and electric fencing), make Kommetjie Road a forbidding route for pedestrians and cyclists, outside of peak traffic times. For ease of reference, Table 3-5 repeats the data available in Figure 19.

Table 3-5: Traffic Incident Data for Kommetjie Road (including bicycle incidents), 2010-2015 (Source: TCT, 2016)

Letters refer to indications on Figure 19

	Functional description / local name	Intersecting road	Total traffic incidents 2010-2015	Of these, total involving bicycles
	Kommetjie Road (Location Not Specified)		625	22
Intersections with Kommetjie Rd				
A	-	Slangkop Rd	70	3
B	Ocean View Robots	Milky Way	20	
C	New Masiphumelele [Masi.] Access Route	Abington Rd	0	0
D	Masi. Robots	Pokela St	23	1
E	-	Lekkerwater Rd	17	4
F	Capri Robots	Capri Dr/Palm Dr	66	5
G	NMT Link to Mall/Taxis	Sunnydale Rd	8	1
K	Fourway Robots	OKW/Glencairn Ex-pressway	284	6
L	-	Corsair Way	30	3
M	-	Riverside Rd	32	1
N	-	17th Avenue	39	1
O	Fish Hoek Circle	Fish Hoek Main Rd	49	0
Intersections with Ou Kaapse Weg [OKW]				
H	-	Noordhoek Main Rd	*N/A*	*N/A*
I	Turnoff to Mall	Buller Louw Dr	*N/A*	*N/A*

Chapter 4. Findings and Analysis

4.1 Introduction

This chapter introduces the findings of both semi-structured interviews and focus groups, and of the author's own fieldwork in the study area, over the course of July, August and September 2016. The specific timing of the study, which included national local government elections, proved to be consequential in the case of Masiphumelele, which has a history of public unrest and demonstrations at such times (Esterhuizen, 2016, personal interview, July 10). For this reason, focus groups were postponed to the post-election period. Focus group discussions were recorded and transcribed, before excerpts were extracted and coded, during which a distinction between physical and non-physical factors emerged as an organising feature of participants' experiences of cycling in the Corridor.

4.2 A Personal Account of the Kommetjie Road Corridor

Before critically analysing the research findings from focus groups and interviews in light of the relevant theories and discourses presented in Chapter 2, this chapter serves as an introduction to the particular mobility regime of the Fish Hoek Valley, and to Kommetjie Road in particular. It describes the fieldwork I undertook, my interactions with research participants in each of the three communities, and the issues raised by these participants in preliminary interviews and while cycling around.

Between May and September of 2016, I made more than 25 visits to the Fish Hoek Valley for the purpose of exploring its mobility regime. I travelled the 34km between my home in Three Anchor Bay and the Valley by bicycle, or inter-modally, by riding to Cape Town Station, taking my bicycle onto the train, and alighting at Fish Hoek Station, then continuing by bicycle into the Valley as far as Kommetjie Village. I conducted the entirety of my fieldwork by bicycle or walking, allowing me to intercept other cyclists on their own routes, to strike up conversation while pedalling alongside them, and to approach commuting cyclists with a measure of equality. Spending evenings and mornings moving up and down the walking and cycling corridor that links Ocean View and Masiphumelele at one end, with the Sun Valley Mall and Fish Hoek CBD at the other, meant taking on the same risks as Valley cyclists, and drawing on my own positioning and wayfinding strategies to navigate the opportunities and hazards of the study area.

The realities of full days of fieldwork in the Valley also meant that my movement patterns diverged from those of my respondents, in that I often had to travel back to Fish Hoek Station close to sunset or just after dark, at a time when most respondents indicated that they would not consider leaving the safety of their neighbourhoods to use the arterial. This exposed me to the very fast motor traffic on the area, the faltering light provided by a single line of streetlights, and the desertion of the roadside spaces and verges along Kommetjie Road, the only physical link between these communities. On several occasions I used the Southern Metrorail line after 8pm at night, when Metrorail staff asked myself and all the other passengers in the waiting train to cluster into one carriage for the trip to Cape Town. The staff member explained that this would offer a degree of protection against crime – we, the passengers, were thus being instructed to protect each other from dangers common enough to warrant this degree of intervention from Metrorail staff. This strategy, on the part of Metrorail, is indicative of the tenuousness of the mobility links by which Valley residents participate in the life of greater Cape Town. Since road transport links between the Valley and Cape Town are prone to constant delays and, occasionally, to a complete cut-off of the Valley (Far South Peninsula Community Forum [FSPCF], 2015), the railway line constitutes an essential link for commuters; yet the service it offers to passengers is far from safe or reliable (ibid), and the service it offers to passengers travelling with bicycles is hostile (Jennings, 2015).

On another occasion, I spent an afternoon with Mr James Esterhuizen, the proprietor of a community cycling initiative in Ocean View, cycling the 15km return trip to the beach at Scarborough. The proprietor and I were two adult males in charge of about 20 children of between 10 and 15 years of age; most were already competent cyclists. We rode along the narrow shoulder of Kommetjie Road

Figure 21: Setting off with Ocean View children on a group ride. *A woman pushes a pram along the arterial road, there being no road shoulder and no sidewalk here.*

Figure 22: A group ride to Scarborough. *On this popular cycling route, a lack of road markings and shoulder means that cyclists must yield to passing cars by leaving the roadway repeatedly.*

as it leaves Ocean View in the direction of Kommetjie Village. At times, the shoulder disappeared entirely. Yet few motorists passing us slowed down, and the majority passed by the line of 20 children on bicycles at less than the 1m separation required by Provincial bylaw[1]. A few motorists approaching from behind hooted at the line of children to yield to the motorists, presumably by moving off the tarred road and onto gravel. These interactions, which continued for the two hours of the return trip, capture a contrast between automobility and subaltern road cultures.

The motorists passing us, who are road users privileged by automobility, used their hooters to discipline a group of cyclists, who are constructed as deviant under automobility. The right of motorists to move forward was invoked by the use of hooters and policed by the implicit menace of close passing, while the rights of cyclists to the road is constructed by automobility as contingent, to be enjoyed unless and until a vehicle capable of greater speed approaches to claim the road. The consequence of this aspect of automobility, in which access to speed is the organising principle of the road user hierarchy, is the belief that improving conditions for motorists improves the safety of all road users. This is due to the fact that road users will, when frustrated by congestion or other constraints to the 'right to speed' conferred by automobility, circumvent the spatial governance of the street to recover the right to speed. An example of this is the way in which taxis on Kommetjie Road ramp up onto the raised sidewalk, sending pedestrians scattering onto the gravel verge. However, this extreme example exists on the same spectrum as motorists' use of the 'emergency lane' (demarcated by a yellow line) to bypass a long turning-lane queue at intersections, which I observed countless times throughout my fieldwork.

It is clear that, for the authors of the South African Pedestrian Environment Assessment Tool, it is expected that motorists will tend to disobey the laws of the road whenever doing so would prove convenient, and that this will take place at the expense of pedestrians on the sidewalk. This relationship is predictable enough for Albers, Wright & Olwoch (2010) to include the geometry of the driving environment as a basic determinant of the safety of the sidewalk. In the case of the Corridor, this particular aspect of the PEAT corresponds closely to conditions on Kommetjie Road. However, Kommetjie Road and other arterials are also subject to unique local conditions connected to land use, geography and socio-technical aspects of the Valley. While the basic structuring elements of this mobility corridor have been described in Chapter 3, the process of fieldwork yielded a substantially different understanding of these aspects.

1 The "Safety of Cyclists and Blue Lights Regulations", Western Cape Provincial Gazette Extraordinary No. 7194.

Figure 23: Focus group mapping exercise in Masiphumelele

Figure 24: A5 isiXhosa flyer advertising the Masiphumelele focus groups

MQHUBI WEBHAYISIKILE OBEKEKILEYO

Kudala abantu baseMasiphumelele besebenzisa iibhayisikile ukujikeleza. Iibhayisikile zonga imali nexesha, yaye zikugcina usempilweni.

Kodwa iindlela, ezifana ne-Kommetjie Road, azisoloko zinesithuba esaneleyo ukuze abantu baqhube ibhayisikile ngokukhuselekileyo.

Iingozi zenzeka lonke ixesha, yaye abantu abaninzi abafuna ukuqhuba ibhayisikile abakwazi ngenxa yemingcipheko yokonzakala.

Ndingumphandi osuka kwiYunivesithi yaseKapa ofuna ukuqonda ukuqhuba ibhayisikile eMasiphumelele, e-Ocena View nase-Fish Hoek. Ndifuna ukwazi izinto ezifana nezi:

- yintoni oyithandayo nongayithandiyo ngokuqhuba ibhayisikile
- yintoni ekwenza uzive ukhuselekile yaye yintoni ekwenza uzive usengozini
- yintoni elula kwaye yintoni enzima ngokuqhuba ibhayisikile

Nam ndingumqhubi webhayisikile, andinayo imoto, kwaye ibhayisikile yam lulo lodwa uhlobo lwam lwezothutho (kunye no-Metrorail no-MyCiTi).

Baninzi abantu endibabone beqhuba ibhayisikile eMasiphumelele yaye ndiye ndacela abantu bakwaMasi Bike Shop ukuba bandincede ndiqonde ngakumbi.

Zive wamkelekile ukuza kwintlanganiso emfutshane kwiqela elincinane (abantu aba-5-7) malunga nokuqhuba ibhayisikile, eza kuqhutywa ngesiXhosa nesiNgesi. Siza kuthetha ngamava akho, yaye kuza kubakho imephu ye-Far South apho sinokubhala izinto.

Injongo yolu phando kukwenza izindululo kwisixeko malunga nezinto ezifunwa ngabaqhubi beebhayisikile, ngaphambi kokuba kwakhiwe izibonelelo ezilulutho ezintsha zabaqhubi beebhiyisikile.

Olu phando lumalunga nabantu abasebenzisa ibhayisikile njengezothutho, kodwa abantu abaqhuba ibhayisikile njengezemidlalo bamkelekile nabo.

4.3 Focus Groups

Due to time constraints, and due to the decision to hold two sets of focus groups in each community, my planned form of outreach to cyclists (by means of BEC and bicycle shop proprietors) was complemented by a poster and flyer campaign, in English and isiXhosa (see Figure 24). Focus group attendance is shown in Table 4-6.

Table 4-6: Focus Group Sessions[2]

Focus Group Session and Code Abbreviation	Venue	Date	Attendance
Fish Hoek 1 (FH1)	Fish Hoek Public Library	17.08.2016 18h00-19h30	9 (3 female)
Fish Hoek 2 (FH2)		23.08.2016 18h00-19h30	3 (1 female)
Ocean View 1 (OV1)	Ocean View Multipurpose Centre	02.09.2016 18h00-19h30	10
Ocean View 2 (OV2)		03.09.2016 18h00-19h30	4
Masiphumelele 1 (MS1)	Masiphumelele Public Library	03.09.2016 10h30-12h30	4
Masiphumelele 2 (MS2)		10.09.2016 10h30-12h30	6

In Fish Hoek and Ocean View, strong relationships with the community partners meant that the process of organising focus groups and securing the attendance of participants was relatively straightforward. In Masiphumelele, however, a number of factors rendered these focus groups more complex. The first of these were the South African local government elections of 3 August, 2016, in a context where Masiphumelele has long been the sole seat held by the ruling party in a district, and metro, run by the opposition (Kretzmann, 2016). Mr Morgan Chikumba, the proprietor of the Masiphumelele BEC, with agreement from others present in his shop, cautioned that this would be a tense period in the community, and advised that the focus groups be held as far as possible afterwards. A second constraint was the Masiphumelele BEC proprietor's departure for Zimbabwe, at a time of tension there, to visit his family. This necessitated finding a new community partner in 'Z', the founding proprietor of the BEC, who now works as a tour guide in Masiphumelele. Members of an NGO working in Masiphumelele also cautioned that, for the safety of participants, focus groups should not take place after dark, as in Fish Hoek and Ocean View, and not in the working week or on Sundays, when many residents would be at church. This left Saturday mornings, a time when several cyclists encountered during flyer hand-out indicated that they would be at work. A further constraint was the advice given informally by participants in the first Masiphumelele session, all of whom were from Zimbabwe and Malawi. They explained that Masiphumelele community members viewed the study as being 'for foreigners', ('Thomas', 2016, persona interview, September 3), and that further promotion would be needed to reach South Africans. I then engaged 'Z' as a community partner, and through his network was able to ensure that the second Masiphumelele focus group included South Africans.

Some of the salient aspects of focus group attendance were gender, race, and income differences. Women were present only in the Fish Hoek focus groups. Of these, two were commuter cyclists who practiced pedestrian cycling. However, the other two women were not ordinary members of the cycling public: one was a widely-published cycling researcher, NMT planner and academic, while the other was both a bicycle shop owner and senior local government representative. Although both of these women were local residents relating their personal experiences, their ability to articulate their experiences using technical vocabulary may account for the very marked predominance of 'hard' infrastructure mentions in the Fish Hoek groups. The racial composition of the group strongly reflected the predominantly mono-racial composition of the communities (see Section 3.8.2), with all focus groups apparently consisting of only White (Fish Hoek), Coloured (Ocean View), or Black African (Masiphumelele) participants. As the aim of the study was not to create a detailed demographic profile of cyclists versus non-cyclists, income data was not systematically collected for

2 Participants in all groups were male, except where stated.

all focus groups. However, surveys introduced for the Ocean View and Masiphumelele sessions[3] reveal that monthly incomes for these groups were lay within or near the median income band recorded in the 2011 Census[4]. For example, the average monthly income among participants in the two Masiphumelele focus groups was R3162; this falls into the second-largest group of monthly incomes in the 2011 Census (R1601-R3200, in 2011 Rands), representing 27.3% of Black African residents of the suburb. Similarly, the average monthly income reported in the Ocean View sessions was R5909, while the median income in the 2011 Census was R3201-R6400 (in 2011 Rands), representing 22.1% of Coloured residents. In comparison, the median monthly income in Fish Hoek was R12801-R25600. Taking into account inflation of 37.3% between 2011 and 2016[5], this suggests that the mean incomes of focus group participants does not differ markedly from that of their communities as a whole. It also underlines the differences between the three communities: White focus groups earned high incomes, Coloured groups earned lower-to-middle incomes, and Black African focus groups earned very low incomes. While the full import of these differences will be discussed below, their most obvious consequence is in equipment. All Coloured and White riders either possessed helmets and lights, or could reasonably have afforded them, while all but one of the Masiphumelele participants stated that they lacked helmets and lights, and stated that they wished to acquire these urgently.

4.4 Coding of Interview Transcripts

All excerpts were transcribed and coded using Dedoose™ browser-based software. The initial coding process yielded 396 codes, which were rationalised and sorted into a code tree, as shown in Figure 25. This classification of codes is subjective, to the extent that many excerpts make reference to 'hard' (physical) and 'soft' (non-physical) factors in a way that is not easily separated. Following Lugo (2013), 'hard' determinants refer to measurable physical attributes of the built environment, such as the design and condition of the roadway links and intersections, sidewalks and verges, as well as the physical context of the roadway, cycleway or footpath. This category includes the attributes most commonly measured by cycling environment assessment tools, and those areas over which transport planning professionals tend to have direct control. 'Soft' determinants refer to all other determinants of cycling, such as the behaviour of road users, perceptions of safety from crime and injury, and weather (Melorose, Perroy & Careas, 2015). This category, in turn, includes elements that are excluded from most cycling environment assessment tools, and which are usually considered to be outside of the direct competence of transport planners.

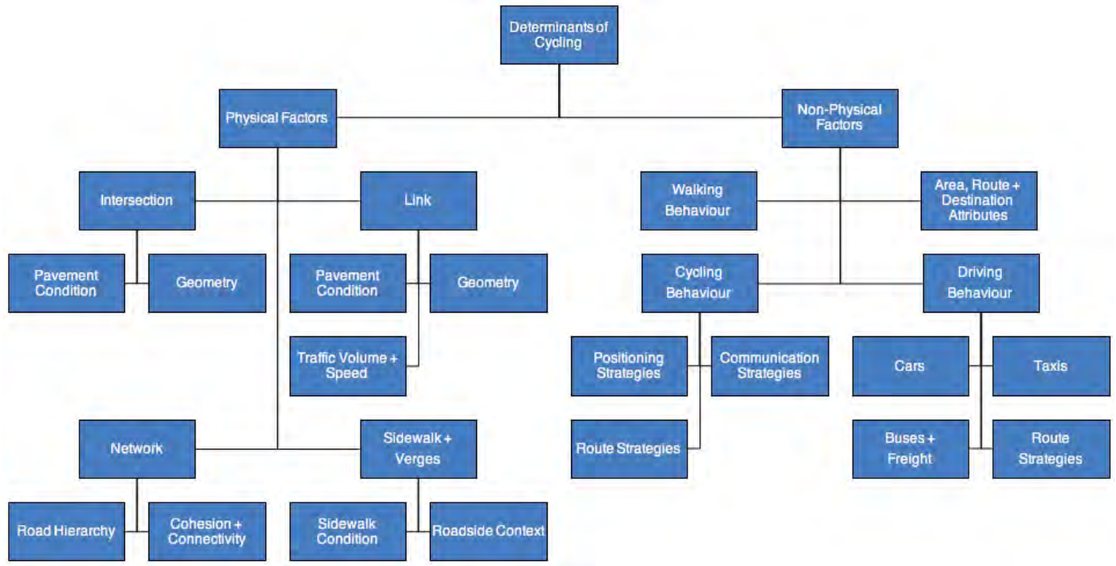
Bridging the gap between the holistic manner in which study participants experience the cycling environment, and the limits imposed by the cycling environment assessment tools discussed herein, is a complex problem that incorporates deep questions about urban planning and mobility. Among the weightiest of these is whether tools developed for measuring automobility ought to be adapted, at this historical moment, to serve non-motorised modes, or whether new tools must be sought for public, shared and non-motorised transport. Given its limitations in time and space, this study adopts the position that, in the planning context of South Africa and at the time of writing, it is appropriate to consider adaptations to existing cycling environment assessment tools. This position is informed by the recent history of NMT delivery and planning practice on the ground, with its discontinuities and fragmentations, rather than the smooth ascent of NMT transport to prominence in policy, discourse and legislation. It also aspires to a sober assessment of the likelihood of widespread availability of non-motorised planning professionals across South African local governments in the near future (Kok, 2016, personal interview, September 9). For ease of reading, the responses of focus group participants below are cited using the following abbreviation: **FH1** and **FH2** for Fish Hoek, **OV1** and **OV2** for Ocean View, and **MS1** and **MS2** for Masiphumelele.

3 Surveys were not conducted in the Fish Hoek sessions as the idea of conducting them, as well as the idea of mapping commutes, was inspired by discussions in the Fish Hoek sessions, and was adopted mid-study.

4 Note that 2016 Rands are being compared to 2011 Rands here, without adjustment.

5 Inflation figures calculated at www.inflationcalc.co.za [Accessed 8 September 2016].

Figure 25: Code Tree



The figure above represents the hierarchy that emerged from iterative coding processes, and which is repeated throughout this chapter at the beginning of each coding section.

4.5 Non-Physical Aspects

Non-physical factors are presented visually, with instance counts, in Table 4-11 (A).

4.5.1 Driving Behaviour

As Chapter 2 has shown, automobility is a powerful organising principle of South African urban space, and is deeply connected with economic power and social prestige. In the Fish Hoek Valley, where a fast, motorised road is the only formal route linking socially and economically diverse settlements, automobility – through the motorised road - shapes all encounters between these groups. Many respondents from the Fish Hoek groups, and several from the Ocean View groups, identify as motorists as well as cyclists. While the range of modal choices they possess are themselves a powerful form of privilege, these respondents alternate between using the motorised centre and the non-motorised margin of the road, and thus encounter automobility from both sides. The cyclists from both Masiphumelele groups are not vehicle owners, and, with one exception, do not drive regularly. Their everyday experience of automobility is thus as minibus taxi passengers, or from the outside, as pedestrians and cyclists who operate in its shifting margins. Given this difference in lived experience, it is thus perhaps surprising that all six groups were in broad consensus on many points relating to driving behaviour in the Corridor.

> Firstly, it was generally agreed that drivers' propensity to obey the law was low. This perception is supported in the literature. The South African government stated in 2006 that 95% of road traffic accidents transpire as a result of one or more traffic offences (NDoT [2006] *in* Beukes, 2011), while Iaych *et al*. (2009 *in* ibid.) showed that in 2009 the country had the 3rd highest road fatality rate in the world, per capita. Cyclists spoke of a need to maintain constant vigilance of both the road ahead and the road behind, as they could not rely on motorists to respect the common principle that the onus for safe overtaking is on the approaching vehicle (Horton, 2007 *in* Horton, Rosen and Cox, 2007). In all six groups, respondents commented on the necessity of yielding to motorists approaching from the rear, even where this meant veering off the road:
>
> "Because I mean this car overtaking is on my side of the road, on the left side of the road, and is approaching me and I've got 2 cm, 3 cm, left or [I] go into the gutter. And he's coming on with [a] speed of 100km/h. What do I do? Go for the car? Go for the pavement?"
>
> (OV1, 02.09.2016)

The difficult choice faced by the cyclist quoted here reflects the contingent nature of cyclists' legal 'right' to the road in the absence of a wider law-abiding road culture. In the MS2 group, another respondent related how minibus taxis sometimes mounted the sidewalk along Kommetjie Road, to overtake in congested traffic. This was echoed by a respondent from the OV2 group, who said:

> "So now from Kommetjie to Masi[phumelele], you get a long line of traffic up until the intersection…but then we have the taxis driving in the yellow line with two wheels on the pavement. So, where must the people cycle? This is an everyday thing; it happens on a daily basis."
>
> (OV2, 03.09.2016)

This quotation illustrated Kommetjie Road motorists' tendency to appropriate not only the road shoulder, but the grade-separated pedestrian sidewalk itself. Although the National NMT Guidelines call for a vulnerability-based hierarchy of road users (Vanderschuren et al., 3), in which private motorists yield to all other road users, the 'might is right' approach illustrated in the account above may more closely describe the actual order of modal priority on Kommetjie Road.

Apart from minibus taxis, respondents also noted that heavy or wide vehicles, such as buses, lorries, and vehicles pulling trailers, posed a particular danger:

> "Especially trucks and taxis are dangerous."
> (MS1, 03.09.2016)

> "When the road is small, you are more taken by surprise, and you are scared until the big truck has passed you. That's when you have that sigh of relief."
>
> (MS2, 10.09.2016)

> "And some of the bigger truck and bus drivers are the worst culprits."
>
> (FH1, 17.08.2016)

> "The issue there is big vehicles like trucks and buses. Besides them you have a slipstream, when they are just passing. It's busses, trucks or any vehicle with a trailer. So, on a corner, they pass you and the road narrows, when a trailer passes you it's a lot closer than when the front of the vehicle passes you."
>
> (OV2, 03.09.2016)

Of the CEATs included in this study, all but two specifically measure heavy goods vehicles as a percentage of motor traffic (as do the City of Cape Town's own counts in Figure XX). However, none measure the equivalent of minibus taxis as a separate category, whereas respondents differentiate between minibus drivers and other vehicle types. A respondent with experience in local government noted that private motorists had a particular animus for taxi drivers:

> "People hate them…We all do stupid thing sometimes, but it is always about the taxis, so [people] will not leave a box open to let the taxi through…[Taxis] are taking people to work, that is what they are doing…They will give you a gap."
>
> (FH2, 23.08.2016)

A female cyclist who is a transport professional stated that "People always blame the taxis but it's not the taxis." Given that both these respondents were speaking in all-white, middle-class groups, they may have been attempting to counter a supposed antipathy among these groups to the extralegal, survivalist road culture epitomised by the minibus taxi (Czeglédy, 2004). Irrespective of the various respondents' views on this mode, however, the local official's words above are a reminder that taxis are an unscheduled form of public transport making spontaneous stops beside and in the roadway, which places unique demands on cyclists using the road shoulder. A final aspect of driver behaviour worth noting is that respondents experienced the road culture differently in other parts of the city and its environs:

> "I was in Stellenbosch last year. I was very surprised because they have got a lot of cycle tracks there because of the University and all that…we were riding back…and we come to the [circles] and cars were actually stopping, which was quite amazing."
>
> (FH2, 23.08.2016)

This finding reinforces the argument that driving behaviour towards cyclists may differ from one local area to the next (in the case above, over a 50km distance). While the CEATs in this study either omit driver behaviour or measure it in a fragmented way, the examples above show that it diverges markedly from official prescriptions within the study area, and that this has a major impact on cyclists.

4.5.2 Cycling Behaviour

My analysis of respondents' accounts of cycling in the Corridor revealed two kinds of strategy. The first involved decisions about positioning on the roadway, and were related to the speakers' degree of cycling confidence and experience. The second related to the cyclists' choices about routes, and the timing and manner of travel. Taken together, these strategies are useful in understanding why road user group already vulnerable to injury would engage in seemingly risky behaviour, such as contraflow cycling on a busy arterial road, as well as the sometimes sublte ways in which cyclists take safety cues from their environment.

4.5.3 Positioning Strategies

Out of 37 participants, only 4 were women, all of whom were from the white, middle-class Fish Hoek groups. Of these, 2 were self-described 'pedestrian cyclists', who avoided the roadway as far as possible, and could make social calls, run errands, and reach favourite destinations almost entirely by means of sidewalks and off-road cycling paths. As Aldred, Woodcock & Goodman (2015) have shown, gender and age differences in the cycling population are high where cycling is rare, and low where cycling is common. In addition, the gender differential whereby women cycle at far lower rates than men, is "culturally specific, and most pronounced in low-cycling, English-speaking countries" (ibid:2). In Aldred, Woodcock & Goodman's survey of recent studies, reasons put forward for this include women's greater sensitivity to risk, the challenge of journeys involving children, and greater aversion to sharing the road with motorised traffic (ibid). For this reason, the views of two older women who choose to cycle, but avoid the motorised roadway, offers an insight into the gender gap in cycling within the Corridor.

> **"**…If I see a car, I'll act like a pedestrian - I'll get off my bicycle and I'll wait for the car to go, or I'll cross the road with the bicycle. So I change from cyclist to pedestrian when there's a car."
>
> 'K', an older female (FH1, 17.08.2016)

-

> "I plan my route…if it's going to be along Main Road, or somewhere where I can't actually go on the pavement, because I'm a pavement cyclist. I often find that it's too dangerous on certain routes. I do work out if my route is possible."
>
> 'J', a female retiree (FH1, 17.08.2016)

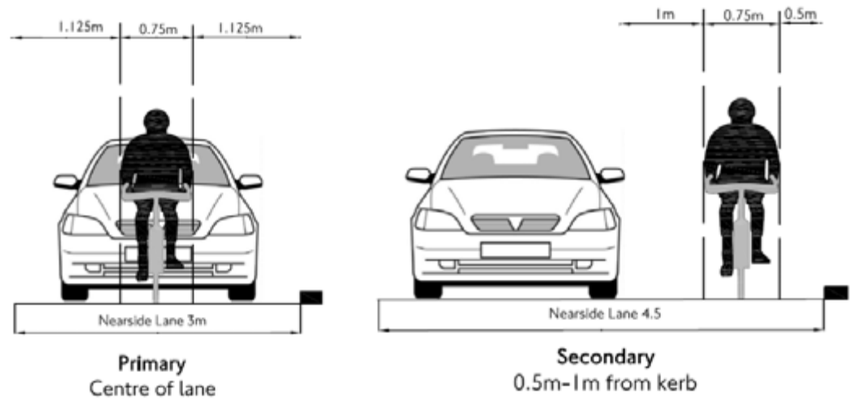
As the above quotations show, 'K' and 'J' use the sidewalk as a cycling network, and the quality of the sidewalk determines whether a route is "possible". For this reason, the two respondents above would face challenges in leaving their immediate neighbourhood by bicycle, given the high-stress nature of the few routes leaving the Valley and the lack of alternatives to Kommetjie Road, as well as Kommetjie Road's lack of continuous sidewalks. This suggests that, if a South African CEAT were to capture the determinants of cycling for 'K' and 'J', it would be necessary not only to consider the surface condition of the sidewalk, but whether the sidewalk (along with low-stress links) constituted a viable network, such as 'K' and 'J' have found in their own neighbourhoods. This is discussed further in Section XX[Sidewalk] below.

The remaining 94% of the respondent sample were vehicular cyclists (33 men, 2 women), who cycled in the motorised roadway. These cyclists noted traffic volume, traffic speed and lane width (the key criteria of the BLoS method) as important determinants of their cycling practice. However, the respondents showed an income divide in their positioning strategies. In the high-income Fish Hoek and relatively higher-income Ocean View groups, cyclists reported that they would assume the primary position (also known as 'taking the lane'), holding off motor traffic from overtaking until the cyclist felt that the roadway permitted safe overtaking, when he or she would return to the secondary position:

> "If I notice or I hear a bus is coming and I see a corner is coming up then I move more towards the centre of the road to prevent them from overtaking me, until I know that I am on a straight stretch where I know I am safe for this vehicle to overtake me."
>
> (OV2, 03.09.2016)

Given the contested and car-centric nature of the roadway discussed above, and cyclists' disproportionate rates of injury and death because of collisions with motor vehicles, this manoeuvre requires a measure of confidence. With one exception, it was not mentioned by respondents from Masiphumelele, who stated that they would take to the sidewalk when cycling became difficult in the road:

Figure 26: Cycling Position (Source: Source: Welsh Government, 2014:44)



> "I can say…when the road is busy, then we're going on the pavement."
>
> "When the road is too small, I have to cycle on the pavement."
>
> "[Interviewer:] 'And do you ever go onto the pavement because the traffic is too fast?'
> [Respondent:] 'Yes…from here until the Fish Hoek robots…the taxis are driving too fast.'"
>
> Various respondents (MS2, 10.09.2016)

The excerpts above illustrate that the confidence required to ride on the roadway is not necessarily the same as that required to assume the primary position. This supports the argument that the sidewalk should be scored as a cycling network separately from the roadway, as the cycling constituencies who depend on each do not overlap in certain cases.

4.5.4 Aural Cues

Respondents often mentioned the importance of aural cues in their positioning on the road. These took several forms. For example, pedestrians walking next to noisy roads were often unable to hear cyclists on the sidewalk or sharing pedestrian space (FH1, 17.08.2016). In the extract on 'taking the lane' above, the respondent noted that he change his positioning when he *heard* a bus coming. An older cyclist noted that "you don't have rear view mirrors, so you depend on your ears…if the wind is blowing [and hearing is difficult], that's another problem" (FH2, 23.08.2016). In Section XX below, rumble strips were mentioned by respondents as useful aural cues for motor traffic speed and type. Road noise is measured by only one CEAT, that issued by Transport for London; for the reasons above, it may be a useful component of an SA CEAT.

4.5.5 Route Strategies

A constant sight of my fieldwork along the Corridor was the daily rush of contraflow bicycle traffic heading along Kommetjie Road to Masiphumelele from transport and employment hubs in Sun Valley and Fish Hoek. As an adaptation to the cycling environment, this behaviour will be discussed in Section XX below. As a route strategy, this behaviour is one of a number of strategies that seem to enhance cyclists' safety in a way that may not be apparent to non-cyclists.

Among the many route-finding strategies mentioned by respondents, the majority were aimed at avoiding crime. For example, men from the MS2 group stated that they would not cycle when it was dark, or when Kommetjie Road was quiet, since "you will find yourself alone in the road" (MS2, 10.09.2016). Cyclists from Ocean View avoided cycling in the early morning dark, except in groups, especially towards Cape Point, "because there, are many people got robbed on their bikes" (OV1, 02.09.2016). This suggests that high-quality street lighting (measured in units such as lux) is an important criterion for a South African CEAT. It also suggests that group cycling is a key factor

enabling cycling at economically important times (such as winter work commutes, when sunrise takes place as late as 07h52[6]). A prospective SA-CEAT might therefore aim at capturing the relationship between the physical requirements of group cycling (cycle path or road shoulder width, visibility) and the contextual elements, such as perceived risk of crime, that deter cyclists from riding alone.

The excerpts above referred only to Kommetjie Road, with respondents reporting a feeling of safety 'inside' their respective communities. This was mentioned across all three socio-economic contexts:

> "[Previously] we would be worried about our bicycles, but nowadays here in Masi[phumelele] we are safe…looking after each other"
>
> (MS1, 03.09.2016)

> "As I say, I cycle mainly in Fish Hoek itself. I will cycle at night too…I mean the wife says to me, 'You're mad, get in the car'. But I don't feel threatened at all, nothing whatsoever."
>
> Male retiree, 'N' (FH1, 17.08.2016)

> "What is deterring people from getting on a bike and commuting outside of Ocean View is safety"
>
> BEC proprietor (OV1, 02.09.2016)

"No, I never cycle at night. But around here I do cycle at night. Maybe coming from a friend's house or wherever. Because that it is the quickest way for me…But also, if you feel safe in the area you are, then you will ride around. So I'll stay down there in my areas, it's safe there."
(OV1, 02.09.2016)

These excerpts contribute to a general picture in which Kommetjie Road, outside of busy and well-lit times, becomes a barrier to movement, rather than a link. However, during peak times, when the perception of crime risk is lower, a different class of cyclist is excluded by the prospect of mixing with congested motor traffic:

> "[Fish Hoek] is a very conducive environment for cyclists, provided you stay…away from the main roads, like Kommetjie. Fortunately, I can. So if have to go through to Kommetjie I take the back [roads]…invariably I'll go out of my way. I can't choose the easiest one, the one that the motor cars take."
>
> Male retiree, 'N' (FH1, 17.08.2016)

'N''s comment above is revealing in its acknowledgment that deviation ('invariably I'll go out of my way') is a price that must be paid for separation from motor traffic (especially in conjunction with his quotation above, in which he mentions cycling at night without fear). 'N''s admission that he is fortunate to be have this choice may refer to his status as a retiree who no longer commutes. However, it could also apply to his living in Fish Hoek, where the highly permeable road network offers many low-stress yet reasonably direct alternatives to Kommetjie Road.

For 'J', a female retiree and pedestrian cyclist, the risk of crime comes from pedestrians, meaning that she avoids routes on which she sees men (of colour) walking:

> "Along Nelson Road, there are often [men of colour] walking, who don't have bikes, who have to walk back to Masi, and as soon as I see a little group, if I can, I detour them, because I'm very much aware that they can push me off my bike and…then it's tickets. Or I will turn around and I will go, then I will go into Kommetjie Road and I will stay on the pavement to get to Sun Valley."
>
> (FH1, 17.08.2016)

For 'G', an experienced woman cyclist, higher volumes of motor traffic were a positive factor in choosing where and when to cycle, suggesting that a high-volume road such as Kommetjie Road is an important source of surveillance for cyclists: "the more traffic there is, the safer you are…" (FH1, 17.08.2016). However, 'G' also expressed anger at the fact that news of a series of muggings had caused her to stop using a favourite cycling route within the Valley ("In terms of where I have stopped cycling, it's all crime related" [FH1]). In both the female respondents' accounts above, they possess several alternative routes that can be used to avoid perceptions of crime risk. They are also both middle-class, and have access to private motor vehicles.

This is due to the fact that the street network in Fish Hoek offers a fine 'mesh' of streets, as the London and Wales CEATs refer to it, with closely-spaced intersections and a number of NMT-only physical links allowing a high degree of route choice, and avoidance of Fish Hoek Main Road and Kommetjie Road without significant deviation.

For respondents from Masiphumelele and Ocean View, their encounters with crime were also many – and, especially in the case of Masiphumelele residents, immediate rather than reported – but the responses available to them were limited. While respondents from Ocean View and Fish Hoek also recounted encounters with crime, their responses were constrained by the absence of a physical alternative to Kommetjie Road as a link to employment and urban opportunities. Their options were thus to limited to cycling in groups, cycling only in high-visibility conditions, or transferring to another mode, such as taxis or (in Ocean View) carpooling.

6 TimeandDate.com, 2016

4.6 Physical Factors

4.6.1 Introduction

The codes appearing below were applied to excerpts deemed to relate to 'hard' determinants, or physical attributes of the built environment. Following the distinctions employed in the Cycling Environment Assessment Tools in Table 2-3, these have been divided into functional sections. 'Intersection' and 'Link' are defined in the same way as in the BLoS units of analysis in Figure 6. 'Roads' includes remarks relating to specific roads within the Study Area, while 'Network' relates to higher-order considerations of directness, coherence and other criteria drawn chiefly from the London and Welsh tools. 'Sidewalk + Verge' includes the sidewalk and considerations relating to the environment abutting the link, such as land use types and social safety, and is drawn mainly from the South African PEAT.

4.6.2 Intersection

Intersections are an especially contentious subject in the cycling planning discourse, as they account for a majority of cycling fatalities worldwide (Bonham & Johnson, 2015). Intersections also present particular challenges for cyclists operating in the motorised street, for a number of reasons. Firstly, bicycles only remain upright while moving, meaning that cyclists become vulnerable to falling when brought to a stop, and when starting to move. Four-way intersections, among others, require cyclists to confront oncoming traffic that may turn in front of them. For cyclists in emerging cycling contexts, the experience of asserting one's right to way against a motor vehicle weighing a tonne requires a degree of confidence that exceeds the comfort level of many riders. Successfully negotiating South African intersections, as respondents remark below, further requires tacit engagements such as making eye contact and signalling intentions using subtle gestures[7], in a road culture marked by a high degree of informal, negotiated behaviour. It is the tacit nature of these negotiations, and the understanding that simply asserting one's rights in the law is unlikely to confer protection in practice, that was named as an inhibiting factor by female respondents in particular.

The Valley possesses a wide variety of intersections, including some that are uncommon in Cape Town. Fish Hoek is noted for its hexagonal road system, resulting in many circles, which a retired male respondent noted as a particular danger, since "People just do not see you" (FH1, 17.08.2016). This reflects a concern related to the particular geometry of roads in central Fish Hoek, where 60 and 120-degree angles are common (see The Valley's multi-lane intersections were commented on in all six focus groups, in ways that closely reflect the concerns of tools such as BLoS, where elements such as the number of turning lanes and the width of the cross-streets attract penalties. For example, an experienced male cyclist noted the difficulty of moving into a continuing lane at the approach to intersections on Kommetjie Road, where the outside lane – where cyclists must ride by law – becomes a dedicated turning lane (OV2, 03.09.2016). Two respondents noted that taxis are inclined to move into a turning lane as they approach intersections on Kommetjie Road, only to continue straight through the junction (OV2, 03.09.2016). This highlights a theme that is absent from the CEATs sampled, none of which measure the extent to which motorists comply with roadway directions.). At the centre of some hexagons are traffic circles, which several respondents noted as the sites of collisions between themselves and motorists. Pedestrian cyclists in particular, mentioned that traffic circles were a major deterrent, given the high degree of skill and confidence required to navigate them successfully, such as the necessity of indicating using one hand while maintaining a constant turn and simultaneously observing oncoming lanes for approaching traffic. Experienced cyclists noted that they were comfortable using these circles (FH1, 17.08.2016), although two group members had been involved in collisions at circles in the area.

The Valley's multi-lane intersections were commented on in all six focus groups, in ways that closely reflect the concerns of tools such as BLoS, where elements such as the number of turning lanes and the width of the cross-streets attract penalties. For example, an experienced male cyclist noted the difficulty of moving into a continuing lane at the approach to intersections on Kommetjie Road, where the outside lane – where cyclists must ride by law – becomes a dedicated turning lane (OV2, 03.09.2016). Two respondents noted that taxis are inclined to move into a turning lane as they approach intersections on Kommetjie Road, only to continue straight through the junction (OV2, 03.09.2016). This highlights a theme that is absent from the CEATs sampled, none of which measure the extent to which motorists comply with roadway directions.

Another common determinant of cyclists' experiences is the extent to which signalised intersections are actually operational. For the entire duration of the study, for example, the sole signalised pedestrian crossing allowing pedestrians and cyclists to cross Kommetjie Road at the entrance to Masiphumelele, was not operational. This metric is also absent from all of the CEATs, although it was mentioned by participants from Masiphumelele as a major deterrent to crossing Kommetjie Road. In a road culture where pedestrians' and cyclists' rights of way are commonly overridden, the absence of a working signal at the pedestrian crossing in Figure 4-12 effectively removes the pedestrian crossing, since respondents did not feel that the white paint that remained had any coercive force on its own (MS1, 03.09.2016). On occasions where the signals were operational, the timing on them was considered to be biased towards motorists: "They never work…they only work in certain times, and most of the times they are green, you never see them red" (MS1, 03.09.2016). These concerns were shared by an experienced middle-class cyclist from FH2, who stated that he would not allow his son to cycle to school in Kommetjie Village for the sole reason that doing so would require him to use the pedestrian crossing on Kommetjie Main Road. Another respondent noted in agreement that, since the crossing had been installed, "the cars go even faster through [it]" (FH2, 23.08.2016).

Another aspect of intersection design that was relevant to respondents is the fact that they are seldom designed in a way that acknowledges them as sites of increased vulnerability for all road users. Cyclists who may feel a reasonable degree of confidence while in motion, effectively become pedestrians at an intersection, as they are forced to come to a stop and partially dismount, and are then at risk of being pushed over or bikejacked. This is significant since many respondents from Masiphumelele stated that they generally felt significantly more vulnerable as pedestrians than they did as cyclists. Respondents further stated that there are many places, such as parts of Kommetjie Road near sunset, that they would cycle through but not walk through. For these respondents, being forced to dismount at intersections means temporarily assuming the heightened vulnerability of the pedestrian in a context where they would not choose to walk.

A very high degree of the mentions of intersections throughout all six focus groups were related to crime; two respondents out of 7 in the MS2 group related armed bikejacking attempts that they themselves had survived at signalised intersections in Ocean View. Respondents in the FH2 group mentioned that on Kommetjie Road, taxis and buses tended to stop either inside intersections – such as where a kerb is built out for a pedestrian crossing – or immediately before or after intersections. This longstanding element of driving behaviour was not reflected in roadway design, with minimal provision of embayments along arterial roads, or at intersections. In a theme that would recur throughout the focus groups, respondents mentioned that what might be termed the gap between prescriptive and descriptive roadway design was of immediate concern to cyclists, as the most vulnerable vehicles on the road. That is to say, respondents frequently noted that the actual behaviour of road users (whether cyclist, pedestrian or motorist) did not match the behaviours mandated by the design of the road. As an OV2 respondent noted, "You as a cyclist or a pedestrian, where do you go if a car comes spinning at you?" (03.09.2016).

The concerns mentioned in relation to 'Intersections' are a good introduction to those expressed in relation to 'Links', since it could be argued that intersections serve as an intensifier for roadway encounters. They are the one place where being stationary makes cyclists most vulnerable to both

7 These gestures may include nods or dips of the head as an indication of turning direction, and exclude the official hand turning signals mandated by law for cyclists.

crime and injury – a perception amply borne out by statistics (see Figure 19, where most injuries and fatalities occur at intersections, even those a short distance apart), and corroborated by respondents' comments. Intersections are also a site where the politics of the road gains in complexity, as the issues of priority and legitimacy in the traffic stream are made real for cyclists, whose rights of way, and right to the road at all, is contingent in South Africa. This is encapsulated in the strategies of two Masiphumelele respondents as they navigate intersections. In Figure 42, a cyclist crosses a 30m-wide intersection using a 45m arc, and including a dead stop in the middle of the intersection as he waits for oncoming traffic to pass (on a road where the posted speed is 60km/h). Figure 43 shows the route of another respondent through another 30m-wide intersection, who must navigate three lanes of overtaking traffic and three lanes of oncoming traffic over a 50m distance, also involving a dead stop in between the two streams. Figure 44 reflects a different strategy, used by two foreign nationals from the MS1 group, both of whom work outside of the Valley. These respondents chose to become pedestrians at the intersection, dismounting and pushing their bicycles across the pedestrian crossing, judging it too dangerous to ride (MS2, 10.09.2016). What is interesting about this strategy is that the road on which they continue their journey, the Glencairn Expressway, is a fast arterial, with no further exits for more than 5km (see Figure 18). Their survey answers reveal that they are both experienced and lifelong cyclists, and their route choice shows that they are comfortable with close proximity to fast-moving motorised traffic. Yet they prefer to cross the intersection on foot, despite the fact that videos taken in August 2016 show that the wait for a pedestrian green light at this intersection was more than 6 minutes[8].

4.6.3 Link

After intersections, links were the second most commonly mentioned topic during focus group sessions. Counts for these responses are shown in Table 4-8.

8 Recording made by the author on 3 September, 2016.

Table 4-8: Focus Group Responses to Intersection Factors

	Total Respondents	Intersection	Circles	Capri Intersection	Intersection Geometry	Lack of Signals	Masiphumelele Intersection	Ocean View Intersection
Census Group: Black African (M)	14	4					2	2
Census Group: Coloured (OV)	10	**8**		3	3	1	1	
Census Group: White (FH)	12	**13**	3	3	3	1		3
Focus Group: Fish Hoek 1	9	**7**	3	1	2			1
Focus Group: Fish Hoek 2	3	**6**		2	1	1		2
Focus Group: Masiphumelele 1	10	0						
Focus Group: Masiphumelele 2	4	4					2	2
Focus Group: Ocean View 1	4	2				1	1	
Focus Group: Ocean View 2	6	**6**		3	3			
		25	3	**6**	**6**	2	3	**5**
Featured in Composite CEAT Criteria:					Y	Y		

Figure 27: Pedestrian Crossing to Masiphumelele ('D' in Figure 18).

"Lights are almost always out of operation at this pedestrian crossing" (MS1, 03.09.2016), as one respondent noted, which is the only NMT crossing allowing the estimated 38,000 residents of Masiphumelele to cross Kommetjie Road at the main entrance to the settlement.

4.6.3.1 Public Transport on the Roadway

Respondents spoke often of the movement patterns of taxis as posing a distinct challenge to cyclists. Based on my own experience of taxis on Cape Town roads, I expected that respondents would mention the unscheduled stops they make, frequently and at short notice, along the same road edge that cyclists are compelled to use. However, what respondents mentioned more often than this movement pattern itself, was the way in which passengers alighted from taxis that stopped on the roadside at some distance from the kerb (FH1, 17.08.2016). Passengers would leave the taxi and make their way to the kerbside on Kommetjie Road, often without checking for oncoming cyclists. This was mentioned by an experienced middle-class young male cyclist as a very common hazard – "often the taxi will stop, someone would just get out. And you don't know the taxi stopped unless someone gets out, because it's just standstill traffic" (FH1, 17.08.2016). In his case, this had altered his passing behaviour – he now passes taxis on the right, towards the inside of the roadway, since taxi drivers "expect people coming past on the right because they're more used to motorcyclists". A similar comment was made in both the Ocean View and Masiphumelele groups, suggesting that this response is also felt by cyclists who are regular taxi users.

These comments highlight the respondents' awareness that the existing roadway design does not accommodate the ways in which taxis must move in order to function as public transport. Respondents showed a high degree of awareness of how this shortcoming – in the way Kommetjie Road serves taxis – would have less impact on motorists than it would on cyclists, who must operate in the same road margin that serves as a passenger pick-up and drop-off point for taxi drivers. For one young male respondent from the FH2 group, the solution is an infrastructural one: "...if they had a taxi lane, like only taxis can go in, those things [collisions and near misses] would be less" (23.08.2016). Other respondents agreed, citing taxi lanes they had seen in Johannesburg and Cape Town. For example, one respondent stated that he believed taxis – as a long-established primary form of transport for the city – should be allowed to use MyCiTi bus lanes, in order to give them an advantage over private motor vehicles in city traffic. This discussion in favour of taxi lanes took place in a Masiphumelele group in which taxi use was common, as it is in Ocean View, whereas in the white, middle-class Fish Hoek groups, respondents referred to taxis from an outsiders' perspective, rather than as regular users. In all three settings, respondents mentioned at least once that the embayments provided at certain points along Kommetjie Road were no more frequently used by taxis than any other relatively open section of the road shoulder, suggesting that planned embayments and other taxi infrastructure were not a strong determinant of taxi driving behaviour, and therefore of cycling behaviour. Rather than noting the presence of infrastructure, cyclists were thus more inclined to scan the road carefully for anyone holding out a hand signal for a taxi: "And I know already, I'm prepping already, that this taxi's going to come past, will stop right in front of me. So, you know, and I've been bumped off the road for this R5 that is standing here in front of me" (OV1, 02.09.2016).

4.6.3.2 Legibility and Lines of Sight on the Roadway

As the last comment above shows, respondents were generally highly aware that their safety on the road depended on constant vigilance with,careful observation of driving behaviour. One aspect of Kommetjie Road that complicates this task is the general challenge of seeing and being seen on fast arterial roads such as this. On this road in particular, respondents remarked that levels of street lighting were low, and road markings were faded or hard to see, while official warnings and information was scarce. Of these problems, insufficient street lighting posed the greatest risk, judging by how frequently it was mentioned by participants. To the extent that the absence of street lighting from one side of Kommetjie Road is a determinant of how cyclists move, this is discussed below. What is relevant for hard infrastructural assessments is the fact that lower-income cyclists – such as all but one respondent in the Masiphumelele groups – did not possess bicycle lights, and thus felt at risk when riding along Kommetjie Road in low light conditions. The result is that cycling as a mode of mobility is made unsafe for these residents, who might need to cycle to work in the early morning and home from work in the evening. Connected to this, participants also mentioned the difficulties posed by the setting sun during winter, which shines directly down Kommetjie Road, and into cyclists' and drivers' eyes.

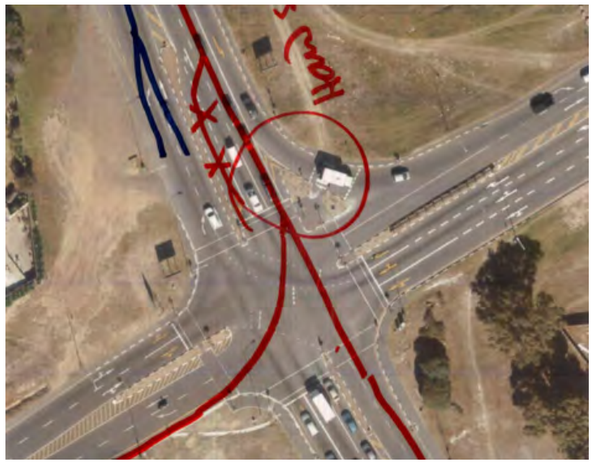
Respondents from all three communities commented on signage, or the lack thereof. A black male cyclist from the MS2 group, who stated elsewhere that he lacked bicycle lights or hi-visibility clothing, noted that the popular recreational cycling routes in the area, like Chapman's Peak, had signs warning motorists to be aware of cyclists, while Kommetjie Road, where cycling was constant all day- and year-round, had no such signs. This criticism was later echoed by an experienced male recreational cyclist from OV1 as well as a white male cyclist from FH1 (17.08.2016), both of whom possessed the full complement of helmets, lights and other cycling safety equipment (ref). A coloured male cyclist from the OV2 group stated that the City should also communicate with cyclists about the condition of the roads (02.09.2016). He stated that signs should explain what lay ahead when roadworks were underway, particularly so that cyclists could navigate the sidewalk and roadway in low light conditions: "Because…you really have to guess, in the dark, what is laying ahead. The road is always dark. They don't put reflector boards or things to warn us of potholes" (ibid). This comment reflects an assumption that the road will be dark into the future, which in turn may suggest that, for this respondent, infrastructure that was not fully operational had become the norm. The request for signage warning of hard-to-see and hazardous road conditions ahead, suggests that both a lack of adequate lighting, and a failure to conduct roadworks in a way that protected cyclists from injury, were to some extent accepted as a given, and were thus not themselves the target of this respondent's call for change.

One aspect of the road surface that respondents raised across the board was road markings, which were felt by both experienced and intermediate cyclists to be of variable quality. For some, such as a male cyclist from the OV2 group with relatively little commuting experience, this was deterrent enough that he used a mountain bike to commute 'off-road', mountain-biking on unpaved earth or embankment adjacent to the sidewalk or roadway (02.09.2016). Another more experienced cyclist from the OV2 group stated that maintenance levels could vary laterally along a roadway, with well-maintained pavement towards the centre and a sudden deterioration along the shoulder, where cyclists ride (ibid). This was particularly dangerous for two reasons. Firstly, in this situation, motor vehicles maintain their speed while cyclists must slow down. This raises the speed differential between them, thus expanding the safety envelope required for the cyclist's comfort. Secondly, the cyclist is forced to swerve to avoid the weathering, rutting, cracking or potholing that went unrepaired at the road's edge[9]. This same cyclist noted that the condition of the yellow line demarcating the road shoulder was often worse than that of the white lines: "it's as though when they resurfaced it they just ignored the yellow line" (ibid). Another cyclist from the OV1 group noted that the road markings currently used were scarcely visible at sunrise and sunset (02.09.2016). A cyclist from the MS1 group noted that the yellow lines were "unclear" due to weathering, making it difficult to ride within them (03.09.2016). A cyclist from the OV1 group mentioned that the yellow line and road shoulder disappeared entirely between Ocean View and Kommetjie, forcing cyclists onto the gravel when cars passed. This respondent also noted that, for a long stretch between the Fourway Stop (Intersection K in Figure 18) and Fish Hoek, the road shoulder was a mere 20cm wide. This was also raised by a respondent from the OV2 group, who noted that this route was popular with young children, as it was the only way for Ocean View and Masiphumelele Residents to get to the beach at Scarborough. A cyclist from the MS2 group noted that in future upgrades, he hoped to see wider road shoulders, with yellow lines that were brighter and thicker. This respondent also noted that he felt safe and comfortable on the Sunnydale Road NMT route that leads from Masiphumelele to the Long Beach Mall Taxi Rank, due to the presence of markings identifying it as a cycling route.

As the respondents' comments show, the presence of road markings is not only valuable as a means of communicating to motorists that they should expect cyclists along the route. Markings, especially where they are clearly legible and visible, seem to serve a legitimating function for cyclists, conferring

9 A possible secondary effect along windy Kommetjie Road, which the author has experienced, is that choosing to slow down due to a poor road shoulder surface condition can also increase susceptibility to being buffeted by sudden gusts of wind.

Figure 28: Intersection 'K' (Figure 18)



The distance travelled by the cyclist (red line) through this intersection is roughly 45m.

Figure 29: Intersection 'I' (Figure 18)

The distance travelled by the cyclist through this intersection is roughly 50m.

Figure 30: A Pedestrian Cycling approach to Intersection 'K' (Figure 18)

At this intersection, the cyclist (black line) opts to dismount and cross the intersection on foot.

Table 4-9: Responses to Link Factors

COUNTRY ↓	CEAT CRITERIA → / BICYCLE LEVEL-OF-SERVICE ASSESSMENT TOOLS ↓	YEAR ↓	LINK																																																																	
				BICYCLE INFRA-STRUCTURE											ON-STREET PARKING						MOTOR TRAFFIC					TRAFFIC DEMAND VOLUMES					LINK GEOMETRY														PAVEMENT CONDITION												PUBLIC TRANS-PORT INFRA-STRUCTURE				STREET AMEN-ITIES			BUILT ENVIRON-MENT					LAND USE PLAN-NING		
			POSTED SPEED LIMIT	PRESENCE OF PHYSICALLY SEGREGATED CYCLE LANE	DESIGNATED QUIETWAY/BIKE BOULEVARD	CAR PARKING FORMS BARRIER TO PROTECT CYCLE LANE	CLEARANCE TO OBSTRUCTION IN BIKE LANE	BOLLARD IN CENTRE OF BICYCLE LANE	PRESENCE OF BICYCLE PARKING	SUFFICIENT WAYFINDING SIGNAGE - SYSTEM NAVIGABLE WITHOUT MAPS	STREET-SIDE BIKE LANE ADJACENT TO CAR PARKING	WIDTH OF BICYCLE LANE	BICYCLE FACILITY LAYOUT ABLE TO BE ADAPTED, INCLUDING TO MAINTAIN QUALITY DURING ROADWORKS	IS FACILITY ABLE TO EXPAND FOR FUTURE GROWTH?	PRESENT AS POSITIVE FACTOR	PRESENT	PARALLEL	OCCUPANCY (%)	ANGLED	(PEAK-HOUR) RESTRICTIONS	POSTED SPEED LIMIT	PERCENTAGE OF HEAVY VEHICLES	AVERAGE DAILY TRAFFIC	MOTORISED VEHICLE RUNNING SPEED	POSTED SPEED LIMIT	OVERALL	LEFT-TURNING LANE	CENTRE TURN LANE	THROUGH LANE	RIGHT-TURNING LANE	PRESENCE OF ROADSIDE 'EVASION SPACE' (BUFFER), ABSENCE OF PHYSICAL BARRIERS SUCH AS GUARDRAILS OR BUILDOUTS	ARE SIDE-ROAD JUNCTIONS FREQUENT OR UNTREATED?	PINCH POINTS/LANE NARROWING	CROSS-STREET WIDTH	WIDTH OF UNPAVED ROADSIDE BUFFER	PRESENCE OF PAVED SHOULDER	WIDTH OF PAVED ROAD SHOULDER	RAISED MEDIAN	RESTRICTED SIGHT DISTANCE	FREQUENT CURVES	MODERATE SLOPES	STEEP SLOPES	WIDTH OF OUTSIDE THROUGH LANE	NO. OF THROUGH LANES	OVERALL SCORE	PRESENCE OF DEBRIS/IRONWORKS	PRESENCE OF (LEGIBLE) ROAD MARKINGS	(BIKE LANE SURFACING) GRAVEL OR TIMBER DECKING	CRACKING	PATCHING	WEATHERING	POTHOLES	ROUGH ROAD EDGE	KERB AND GUTTER	ROUGH RAILROAD CROSSING	DRAINAGE GRATES, SUNKEN COVERS OR GULLIES	TYPE OF PUBLIC TRANSPORT - MBT/BUS	MBT/BUS LANE PRESENT	INTERMODAL TRANSFERS SUPPORTED?	PRESENT	SHADE	SEATING	SIDEWALK OBSTRUCTIONS	ACTIVE FRONTAGES	WIDTH OF STREET FRONTAGE	NUMEROUS DRIVEWAYS	SETBACK OF BUILDING LINE FROM STREET	LANDSCAPING	INDUSTRIAL LAND USE	COMMERCIAL LAND USE	TRIP GENERATION INTENSITY OF ADJOINING LAND USE
	UNIT →		(km/h)	Y/N								(m)	Y/N					%	Y/N		(km/h)	%	veh./day	km/h	km/h	veh./hour					Y/N			(m)	m	Y/N	(m)	Y/N					(m)	no.	Y/N												TYPE	Y/N							(m)	Y/N	(m)	Y/N			trips/day
	MENTIONED IN FOCUS GROUPS →	2016	1	1	1			1	1		1	1	1			1					1	1	1	1	1	1	1	1	1	1			1		1	1	1		1				1		1	1	1	1			1	1	1	1			1	1	1	1			1	1		1	1		1	1	
USA	Davis Bicycle Safety Index Rating	1987															1		1				1		1		1	1		1						1		1	1		1	1	1	1					1	1	1	1	1	1	1	1										1			1	1	
USA	Landis, Vattikuti, Brannick (link), 1997; Landis et al. (intersection), 2003.	1997, 2003																1				1		1	1				1								1						1		1																					1					1
AUS	Guidelines for Assessing Cycling Level of Service (on-road)	2006	1																	1	1	1	1	1	1	1																																													
USA	Highway Capacity Manual	2010										1						1				1		1					1								1						1	1	1				1	1		1																		1		
SA	South African Pedestrian Assessment Tool	2010													1					1															1						1	1				1	1					1									1											
AUS	Victoria Level of Service Audit Tool for Cycling Facilities	2014		1	1	1	1	1			1	1				1								1													1				1	1			1		1	1										1								1					
UK	Cycling Level of Service Assessment Matrix	2014							1	1	1	1	1	1		1						1	1	1	1							1	1			1	1		1		1	1	1		1	1										1			1												
UK	Cycling Route Audit Tool, Wales	2014		1					1	1	1	1										1	1	1							1	1									1	1			1	1	1					1				1															
	TOTAL INSTANCES IN ALL CEATs			2	1	1	1	1	2	2	3	4	1	1	1	2	1	2	1	2	1	5	4	6	4	1	1	1	2	1	1	2	1	0	1	2	4	1	2	0	5	5	4	2	5	3	3	1	2	2	1	4	1	1	1	3	0	1	1	1	0	0	0	0	0	3	0	0	2	1	1

a right to (the outermost part of) the roadway. The fact that comments suggestive of this were forthcoming only from cyclists in the lower-middle and low-income Ocean View and Masiphumelele groups, also suggests that this function may be more important for cyclists on lower incomes who do not also own and operate motor vehicles.

Enhanced road markings – in the form of reflective 'cat's eye' studs and the newer LED 'solar studs' – are used in the Valley, with an experienced female cyclist in the FH2 group noting that they had been implemented along Ou Kaapse Weg to assist drivers with poor eyesight in navigating the road's many bends. This respondent noted that these studs were a hazard for cyclists' tyres, and that they could therefore not be used along the yellow line, noting that for a major annual cycling race, the organisers went as far as to lay rubber mats over them for hundreds of metres at a stretch. This once again reflects the advantage enjoyed by recreational cycling over commuter cycling among those making road design decisions for the Valley. For recreational cyclists, who prize speed and a smooth road surface, and whose tyres are thin, these studs are an inconvenience, whereas for commuter cyclists, for whom safety is more important than performance, these studs may deliver a significant improvement to perceived safety. In the OV1 group, cat's eyes were mentioned by several respondents, most of them also recreational cyclists, who noted that they were an inconvenience in low-light conditions, and usually mentioned them in conjunction with remarks on the lack of street-lighting in general (02.09.2016). This touches on a network planning aspect that will be discussed below in Section"4.6.6 Network", page 454.6.6, namely, that Kommetjie Road is a very different kind of route for motorised and non-motorised traffic modes. For motor vehicles, outside of Fish Hoek proper, it is something close to a limited-access freeway, with reflective studs being common along this type of route countrywide. For people walking and cycling, however, it is a very busy activity route, for which the National NMT Guidelines recommend that both pedestrian and street-level lighting be provided (Vanderschuren et al., 2014). The lack of adequate lighting for pedestrians and cyclists signals that, concerning street-lighting, the designers of Kommetjie Road have thus responded solely to the needs of motorised traffic.

4.6.4 Obstructions on the Roadway

Respondents above have noted that poor road surface conditions can force them to swerve, or make sudden manoeuvres to maintain balance or prevent damage to their tyres. Further, respondents suggested that incursions into the cycling corridor at the edge of the roadway were often made by design, rather than poor maintenance alone. Kommetjie Road, especially within Fish Hoek proper, was punctuated by build-outs – extensions of the kerb that occupied the road shoulder. A female respondent with local government experience (OV2, 03.09.2016) stated that these were designed with the specific intention of preventing taxis from driving in the emergency lane, and that they might be used to accomodate MyCiTi 'peninsula' stops in the future (ref). Whatever their purpose, the lack of dropped kerbs meant that they were an obstacle to cyclists, who otherwise could benefit from a wide shoulder along a fast arterial road (see Figure 4-17). Build-outs feature nowhere in Table 74, although they pose a particular hazard to cyclists. As a narrowing of the cycling corridor, they could be included under the 'Pinch Points/Lane Narrowing' category drawn from the London Cycling Guidelines. However, they differ from these, which are also found along Kommetjie Road, in an important way. Build-outs are singular incursions of the kerb into an otherwise advantageous road shoulder, whereas road narrowings typically result in the disappearance of the on-road cycling corridor. In my own experience of Kommetjie Road, build-outs do deter motorists from driving along the road shoulder, and thus enhance the appeal of the cycling corridor. However, they also remove cyclists from motorists' immediate line of sight, until cyclists are forced into the narrowed road again when they approach the next build-out. Over several kilometres, this repeated exit from and re-entry into traffic is a hazard for cyclists, and more experienced respondents from Ocean View stated that they consequently chose to continue riding in the roadway. For competent cyclists, build-outs thus reduce the effective width of the roadway.

A second kind of obstruction are those on the roadway itself. For example, speedbumps, which were mentioned 8 times in focus groups. One older male respondent from the FH2 group noted that some of the speed bumps in Fish Hoek had been engineered to stop short of the kerb, leaving a gap through which cyclists could pass on the level. However, this respondent elaborated that motorists would also take advantage of this feature by crossing the speedbump at the extreme edge of the

roadway, so that one set of wheels rides level, “kind of forc[ing] you off the road”. An experienced female cyclist in the same group mentioned that speedbumps were seldom well signposted and marked in Fish Hoek, posing a hazard for cycling in low-light conditions. In contrast to speed bumps, respondents reacted more positively to rumble strips. First introduced into South Africa in the 1970s, these are corrugations of crushed stone or blast furnace slag that produce vibration and noise when motor vehicles ride over them at speed (Jobson, 1973). Their design intention is thus solely related to motorists, especially motorists who are distracted or who fall asleep at the wheel. Surprisingly, several respondents agreed that they found rumble strips to be a useful aural cue for approaching traffic, calling them “very good” and “brilliant” at providing information about traffic approaching from behind, and from further away than would otherwise be the case. This raises the possibility that rumble strips could be deployed as a cycling-friendly design feature quite apart from their original intended purpose.

The road surface in general was mentioned as a constraint at least 8 times by respondents from each of the communities. Two experienced Fish Hoek cyclists called the surface of Kommetjie Road “terrible”. Respondents from Ocean View agreed emphatically with the statement voiced by once respondent – that the surface condition of the shoulder of Kommetjie Road was very bad along its entire length, and worst between Masiphumelele and Ocean View. Potholes were raised a further 8 times, and also in all communities, indicating that the integrity of the road surface is a widespread concern among focus group respondents across all three income groups. Ocean View respondents mentioned potholes most often, specifying that hitting one could be costly in terms of repairs to tyres and, for large potholes, to the wheel itself. One respondent from the OV2 group mentioned the injury hazard presented by large potholes: “a rider could be thrown sideways into traffic” (02.09.2016). An experienced female cyclist from Fish Hoek mentioned that road bikes were especially vulnerable to potholes, a factor that was raised several times in both Ocean View groups. These mentions of potholes reveal that, for cyclists, road maintenance is not merely an issue of convenience and comfort, but one of basic safety. For two-wheeled non-motorised vehicles, a pothole represents a serious falling hazard. The use of sturdier, slower bicycles can mitigate this hazard, but only at the cost of increasing the speed differential between motorised and non-motorised traffic, which in turn translates into a wider safety envelope.

Other maintenance-related issues were comparatively minor, such as debris (especially grass) on the road. However, if cyclists are expected to ride on the edge of a shared roadway, and no other designated space is provided, it should be noted that road maintenance schedules must be adapted to the relative vulnerability of bicycle tyres, which are more susceptible to punctures than car tyres. Camber, or the lateral slope of the roadway as it meets the kerb, was mentioned by Fish Hoek respondents with some professional engineering experience, and thus using the requisite terminology, since it affects the ease with which cyclists can maintain their chosen direction of travel, particularly on inclines (FH2, 23.08.2016). This problem was much more pronounced in places where the cycling corridor passes over a deep culvert.

4.6.5 Link Geometry

After the condition of the road surface and the risks it posed to them, the second most common theme among all respondents was space for cycling on the roadway, which included concerns regarding the width of the roadway, particularly the road shoulder, and whether this width was constant or prone to sudden changes. All but one respondent across all of the groups spoke from the assumption that separation from cars was a positive factor for cycling, although several riders, all highly experienced, cautioned that cyclists should never be so far separated from mixed traffic as to be out of the line of sight of motorists. For these respondents, it was essential that cyclists remain a constant visual presence in one corner of motorists’ field of vision. When questioned, these riders from the OV1 group asserted that this was the only way to maintain motorists’ cognisance or awareness of cyclists, such that motorists would, firstly, maintain constant vigilance for cyclists, and secondly, become accustomed to how cyclists move and behave on the road. Another respondent,

Figure 31: Markings identifying Sunnydale Road as an NMT Route

a community cycling activist from Ocean View, noted that a road that was too wide would also encourage faster driving. Respondents’ comments on the geometric design of links thus presented a tension between width and narrowness, and the attendant risks of both. In general, however, wider roads were overwhelmingly framed in a positive light, as long as the extra width was in some way demarcated or could be used as a cycling facility, even if this was only by means of a standard yellow ‘emergency lane’ line.

Respondents from the MS2 group observed that on narrower roads, such as Main Road where it left Fish Hoek towards Kalk Bay, buses and freight vehicles were perceived to be very hazardous, even at low speeds – here, the danger was not only from collision, but from collision with extended mirrors, towbars, or unsecured freight vehicle doors that occasionally swing open. On these roads, there was no evasive space for cyclists, especially where decision-makers had instead opted to accommodate on-street parking. A related concern were the ‘pinch points’, where the road narrowed suddenly. One notable pinch point occurs along a section of Kommetjie Road close to Masiphumelele, which both causes severe cyclist congestion, and thrusts this congestion into close proximity with Kommetjie Road traffic. For one experienced male recreational cyclist from the OV2 group, pinch points – including those created artificially by careless management of roadworks projects – were a major deterrent on Main Road leading to Kalk Bay (02.09.2016) (see Figure 33).

This respondent stated that he would not use this road due to the number of ‘near misses’ he had experienced from trailers towed behind motor vehicles, and heavy goods vehicles in general (ref). He was also aware of several cycling fatalities along this route. For this respondent, the loss of Main Road, which is at sea level, left the 299m climb up Ou Kaapse Weg, at an average grade of 4.3%, as the only way of reaching Cape Town’s Southern Suburbs on his bicycle. A male cyclist of retirement age from the FH2 group noted that slope was a major deterrent to him. Contrary to expectation, for this senior cyclist it was not the slope itself that inhibited his use of routes like Ou Kaapse Weg, but the fact that the road shoulder is not wider here than on level ground, even though uphills greatly affect cyclists’ speed, and consequently their steadiness on the road. In short, steep slopes function somewhat like strong winds, increasing cyclists’ vulnerability to falls and unexpected swerving. Given that the Valley is surrounded by mountains, and that three of the six major roads leading out of it involve steep climbs[10], this is a severe constraint on the mobility of cyclists.

10 Glencairn Expressway: 144m elevation; Chapman’s Peak Drive, 110m elevation; Ou Kaapse Weg, 299m elevation.

Figure 32: Build-outs as traffic calming on Kommetjie Road

While specific sections of routes were identified by respondents as being hazardously narrow, an experienced female cyclist noted that "we are fortunate here – we have got in most instances wide shoulders" (03.09.2016). Other cyclists in the OV2 group (02.09.2016) noted that this caused particular problems when these shoulders disappeared, as they do between Ocean View and Kommetjie Village, because motorists on Kommetjie Road are unaccustomed to sharing the driving lane itself with cyclists, rendering these shoulderless sections doubly hazardous. As was the case with potholes, respondents' approach to shoulderless road sections differed by bicycle type. For road cyclists, the disappearance of a paved shoulder and its replacement with gravel made these sections impassable, except in the driving lane. Here, as elsewhere, commuter cyclists were generally able to navigate along the gravel shoulder. It is noteworthy that, where the cycling corridor becomes substandard, commuter cyclists with sturdy, slow bicycles may enjoy a wider range of possible route-finding responses than road cyclists do. Since half of the female cyclists in the overall sample were pedestrian cyclists, routes that offer no alternative outside of the driving lane (such as the narrow sections of Main Road above) may thus be impassable to pedestrian cyclists, and to women in particular.

In built-up areas, cyclists were confronted with a different set of challenges in the form of driveways and on-street parking. As one young male cyclist from the FH1 group noted, the many driveways giving directly onto Kommetjie Road in central Fish Hoek, and the presence of on-street parking, combined to produce a formidable distraction to cyclists (see Figure 46). As this experienced competitive cyclist explained, he was compelled to look into every motor vehicle he passed for evidence of a motorist about to open a door, and down every driveway for evidence of an emerging vehicle, in addition to the normal sensory workload of navigating an arterial road and its cross-streets in a built-up area:

> You really have to look out for those cars coming in and out of little driveways and things. But I think when you have to worry about pedestrians, as well as motorists from behind, as well as people opening their doors and then, like, a dog, that's when it starts to get a bit tricky because you think, like, "Whoa". And all these things can happen at the exact same time.
>
> (FH1, 17.08.2016)

4.6.5.1 Traffic Flow

As the above responses show, cyclists in the Valley are able to articulate a wide variety of concerns about driving behaviour, which cyclists must observe closely and continuously for as long as they use the roadway. What is of interest in environmental assessment terms is that respondents in every focus group made numerous references to traffic flow in the aggregate, as opposed to the behaviour of individual drivers. A respondent from the OV2 group referring to the narrowness of Main Road, for example, noted that he already took care only to attempt this route at peak traffic times – "Obviously, you travel during peak hour when traffic volumes are right" (02.09.2016) – so that motor vehicle traffic would more closely match his own speed. An experienced female cyclist in the FH2 group, who is involved in local neighbourhood watch initiatives, also stated that non-peak traffic times saw a spike in opportunistic crime, as the verges of some routes became quiet and little frequented. She further noted that this seemed most pronounced along routes which lacked alternative access, such as long stretches of Kommetjie Road that were hemmed in by perimeter fencing and boundary walls. This suggests that differences in peak and off-peak traffic timing is not merely a primary design informant for cyclists' comfort levels on the roadway, but that these factors feed into secondary criteria like perceptions of safety as well. The increasing motor vehicle traffic congestion that besets the Valley therefore offered an improvement in some cycling conditions, provided that roads were narrow enough to prevent compensatory hazardous behaviour (such as illegal overtaking or sidewalk-mounting) by motorists. However, the long-term increase in overall Corridor traffic was a deterrent in itself, particularly for respondents of retirement age; one such respondent, from the FH1 group, noted that he had broken a lifelong habit of cycling medium-length distances "because the traffic is starting to get on my nerves" (17.08.2016). Separately from traffic volume, all focus groups included detailed discussion of motor vehicle speed, and of the link between the design of the driving environment and the speeds motorists commonly achieved. Traffic cameras were mentioned three times in this regard, but only by the middle-income and higher-income Ocean View and Fish Hoek communities, and only by respondents who were, or had been, motorists. Respondents in the OV1 and FH2 group both called for more traffic cameras along the faster, open stretches of Kommetjie Road, and went as far as to specify that average speed cameras ought to be installed. This suggests that cyclists believe the presence of these cameras to be an effective countermeasure against speeding and that the presence of cameras would increase the cyclists' perception of the safety of a route.

4.6.5.2 Cycling Facility

As the preceding sections illustrate, the focus groups in all three communities readily shared a wide range of concerns about their cycling environment, suggesting a high degree of engagement with their surrounds. The fact that specialist cycling facilities were mentioned across all focus groups further suggests that many cyclists also envision their environment as it could be. In the FH1 group, a young male rider with competitive cycling experience stated that he had been in four accidents along Kommetjie Road, and saw the need for a widening of this road along its entire length, or the installation of a cycling lane. In the same group, a retirement-age male cyclist called it a "tragedy" that the long series of upgrades to roads in the Valley did not include any improvements for cyclists (ref, date). In the ensuing discussion, an experienced female cyclist with a knowledge of the design process for these upgrades stated that cycling facilities had been mooted, but then abandoned in favour of more on-street parking and a series of very minor improvements. In the Fish Hoek groups, respondents were uniquely assertive in their discussion of what they perceived to be shortcomings in decision-making on local infrastructure. Many also had firsthand experience of bicycle facilities abroad, and expressed frustration at the limited effectiveness of recent bicycle facilities in Cape Town: "the cycle lanes on the roads…in town, they might as well have not gone that route because that is a complete waste of time" (FH1, 17.08.2016). In contrast, no respondents from Ocean View referred to international examples firsthand, although several mentioned Cape Town's bicycle facilities favourably:

Figure 33: Roadworks management on Main Road in the direction of Kalk Bay

Leaving the Valley by night, roadworks are not managed in such a way as to preserve continuous access for pedestrians and cyclists. The discontinuous sidewalk and road shoulder are in contrast with the roadway, which has been maintained by the use of temporary signalling and staff, provided 24/7.

"What I would like, if you ride from Cape Town, if you take the bus lane from Cape Town to, what's it, Milnerton…You ride that bike lane and I tell you, one of the most safest bike lanes ever."

(OV1, 02.09.2016)

"I went for a couple of rides in Salt River during peak hours…cars are parked there, and the bicycles is there with the cars and you have to go into the road, and the bus is coming up behind you. Then, I like the way they designed the lane because you can see, this is for cyclists, and you can feel free to ride there. But, taxis [ride] in that lane, stopping you wherever you go. But now, if you go in Salt River, I think it's that bit…[describes turning onto the Two Rivers Park cycle track]…it's nice because you can identify the lane."

(OV2, 03.09.2016)

Respondents from Masiphumelele were less assertive when discussing infrastructure. In particular, the MS1 group, who were nationals of Malawi or Zimbabwe, were hesitant when asked what changes they would like to see in the cycling environment. Yet even this group overcame its initial reserve and articulated that cycle facilities like the ones on Sunnydale Road ought to be extended along all of Kommetjie Road.

4.6.6 Network

In the CEATs discussed in Table 74, the two tools from the UK both included criteria grouped under the themes of 'cohesion' and 'directness'. These themes were intended to produce an overall assessment of the network of routes that made up the cycling environment as a whole. Three of these criteria are particularly easy for non-specialists to assess: the fineness of the 'mesh' (that is, the distance between intersections on all routes within an area), deviation (measured as a percentage against a straight Trip Origin-Trip Destination line), and the frequency of stops (measured as the number of times cyclists must stop or yield, per kilometre). Other criteria, like whether cyclists are able to join or leave a route 'safely', are highly subjective, or require specialist knowledge (such as calculating cyclists' Value of Time (CSIR, 2001).

Overall, respondents' comments on the network of routes within and beyond the Valley reflect the structure of the routes themselves. Movement within the Valley is predominantly structured by Kommetjie Road, which was mentioned 23 times. The main finding was that only in historically white, middle-class Fish Hoek and Kommetjie Village did Kommetjie Road function as an access route, with well-maintained sidewalks, working signalised intersections, and a high degree of surveillance onto the roadway and roadside. Where Kommetjie Road passed alongside Masiphumelele and Ocean View, it takes on the characteristics of an inter-urban arterial, with verges devoid of direct surveillance

Figure 34: Pinch Point on Kommetjie Road near Intersection 'D' in Figure 18

At this pinch point, the road shoulder disappears and becomes a turning lane to the left (foreground). Cyclists must proceed onto the yellow wedge in the middle of the image, and then weight for a gap in traffic. Immediately after this point, the shoulder widens again.

Figure 35: Pinch Point further along Kommetjie Road (Intersection 'F')

Figure 36: Responses to Network Factors

	Total Respondents	Network											
			Barriers + Gates	Bottleneck	Perimeter Walls + Elec. Fences	Limited Through Roads	Low-Stress Routes	NMT Network	No Alternative To Arterial	Rat Run	Kommetjie Road	Main Road	Other Roads
Census Group: Black African (M)	14	**10**	1	1	2			1			**5**		
Census Group: Coloured (OV)	10	**16**		1	2				3		**8**	1	1
Census Group: White (FH)	12	**27**				1	1		1	2	**10**	4	**8**
Focus Group: Fish Hoek 1	9	**24**				1	1		1	2	**7**	4	**8**
Focus Group: Fish Hoek 2	3	3									3		
Focus Group: Masiphumelele 1	10	**5**		1	1						3		
Focus Group: Masiphumelele 2	4	**5**	1		1			1			2		
Focus Group: Ocean View 1	4	2									1		1
Focus Group: Ocean View 2	6	**14**		1	2				3		**7**	1	
		53	1	2	4	1	1	1	4	2	**23**	**5**	**9**
Featured in Composite CEAT Criteria:													

Figure 39: The start of the NMT link between Kommetjie Road (Intersection 'G' in Figure 18) and Sunnydale Road.

Figure 38: Traffic along the Sunnydale Road NMT Link

Non-motorised traffic along the Sunnydale Road NMT link. Note the man pushing a trolley, and the many pedestrians walking singly and in groups (07.07.2016)

Figure 37: Sidewalk congestion on the commute home (near Intersection 'E' in Figure 18).

by businesses or homes. To simplify, Kommetjie Road passed by settlements inhabited by people of colour, and passed through settlements inhabited mostly by white residents. This had immediate consequences for respondents. On one hand, Kommetjie Road's arterial character outside of Fish Hoek and Kommetjie proper made for long stretches of clear riding, with few intersections, and a cycling corridor with few interruptions over a roughly 7km stretch. On the other hand, the factors that made the built environment on these stretches relatively conducive to cycling also encouraged freeway-like driving behaviours that made the 'arterial' stretches of Kommetjie Road dangerous, in both respondents' perception and statistical reality. However, due to the geographical constraints on movement around Masiphumelele, and due to poor neighbourhood planning – which leaves Ocean View with a solitary signalised intersection providing access to Kommetjie Road – cyclists have no alternative but to use Kommetjie Road to reach transport and work opportunities in Sun Valley and Fish Hoek. As soon as Kommetjie Road reaches built-up white areas and becomes an access route, however, cyclists also gain the option to leave Kommetjie Road and ride - with the same directness – on a number of low-stress alternative roads. This is due to the fact that Fish Hoek, and its older street layout, enjoys a multitude of signalised and unsignalised intersections with Kommetjie Road and the other arterials that pass through it.

Responses to the 'cohesion' and 'directness' of routes in the Valley were thus lowest for the lowest-income respondents, those in Masiphumelele, who routinely faced very considerable deviations of their journeys, for a number of reasons. The lower-to-middle income residents of Ocean View were also faced with detours due to road design, although Ocean View's greater distance from the trip destinations in Sun Valley, Fish Hoek and Simonstown meant that these deviations, expressed as a percentage of total journey distances, were much lower.

In summary, participants' responses to questions and their mapping of their own commutes, reveals a clear racial distinction. In Fish Hoek, cyclists with lower confidence levels – such as the pedestrian cyclists who mainly keep to the sidewalk –possess a variety of routes leading to key destinations. These respondents spoke of finding their way to the Sun Valley Mall, or Fish Hoek CBD, along quiet back streets. Added to this, they used signalised pedestrian crossings to get to the other side of busy arterials where needed. While Fish Hoek respondents mentioned several crime hotspots, most of which were clustered along Kommetjie Road, they possessed alternatives to most of these, with the exception of Main Road where it leaves the Valley (in both directions). Cyclists in Masiphumelele and Ocean View do not have these options: for them, all cycling trips begin and end with a ride

along a high-volume, high-speed, high-collision-rate arterial road with minimal lighting, deserted and unsurveilled verges and very few intersections (see Figure 55). All respondents from these groups rejected the idea of using their bicycles for transport after dark, beyond the confines of their own neighbourhoods.

Masiphumelele and Ocean View cyclists also have no alternative to the many crime and collision hotspots along Kommetjie Road, for much of its length. These places of perceived and actual danger are unavoidable due to street layout. For Masiphumelele and Ocean View cyclists alike, the only lower-stress sections of their commute begin when they reach historically white areas, such as the Sunnydale Road turnoff (Intersection 'G' in Figure 18). At this point, the crowded and narrow sidewalk has led for 800m from Masiphumelele. Here, groups of people walking four and five abreast share space with wheelchairs, wheelbarrows and trolleys filled with goods and materials, and streams of cyclists in both directions; all of these traveling bodies move unprotected along a corridor in which motor vehicles travel at high speed. At the turnoff to Sunnydale Road, this traffic moves across a short stretch of open land, and through a gap between crash barriers, (see Figure 39) to meet a low-stress route with wide sidewalks, wide lanes, and low traffic volumes (see Figure 38). The Sunnydale Road NMT link is heavily used by pedestrians and cyclists throughout the day, since it leads to a major taxi rank at the Long Beach Mall, offering trips onward to Fish Hoek Station and elsewhere.

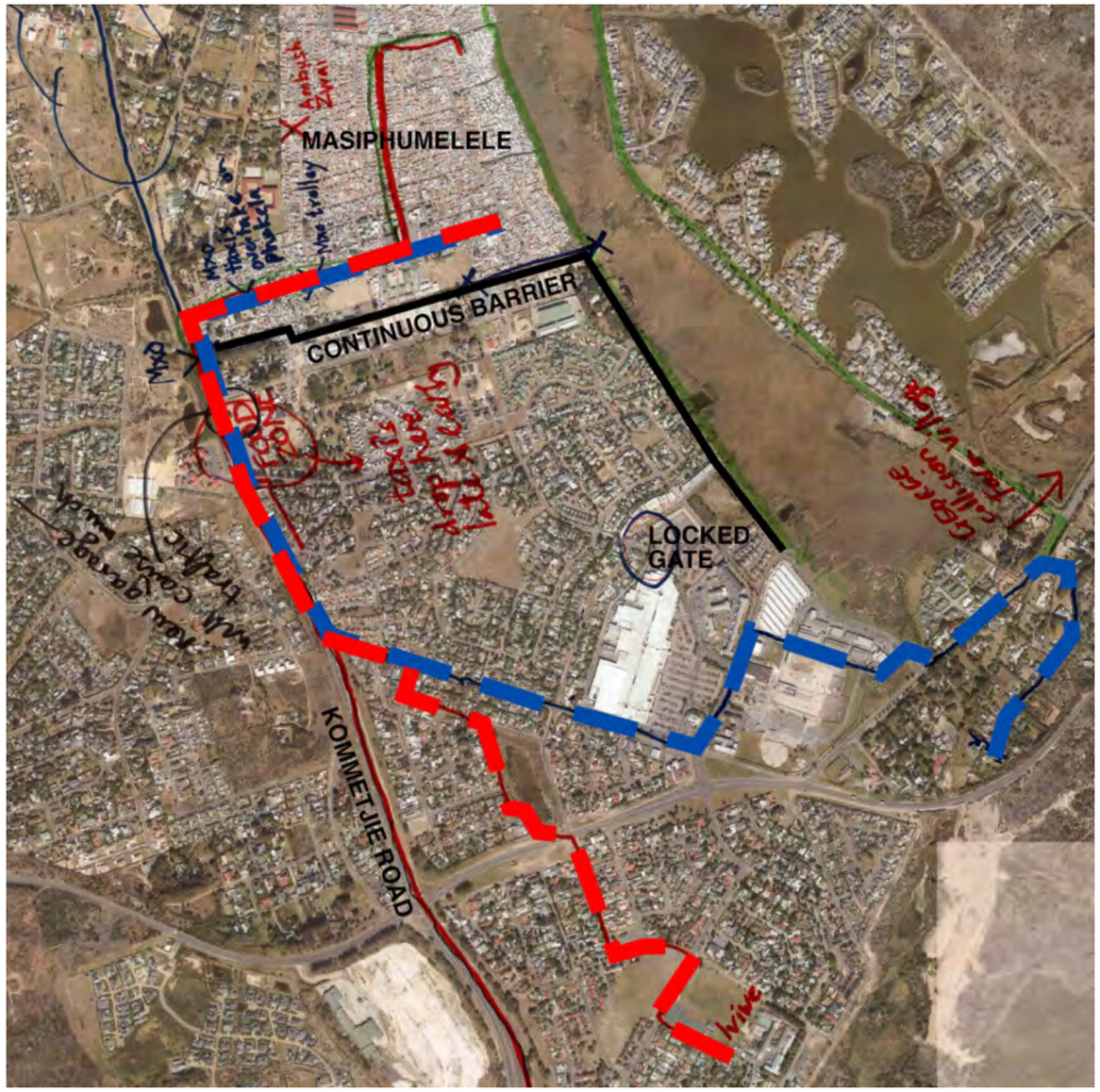
This may explain why only the Fish Hoek groups included women cyclists, why it included so many participants above working age, and why this was the only group to feature cyclists who stated that they almost never travelled along Kommetjie Road. Fish Hoek residents are the only group for whom cycling does not necessitate the use of a high-stress route, Kommetjie Road. This is also the only group for which pedestrian cycling is a mode that offers access to a variety of rewarding destinations, since a great proportion of the destinations common to all Valley residents are clustered in middle-class areas.

This section now turns to a more specific discussion of network effects as experienced by respondents, which are grouped under clusters of codes. As discussed in Chapter 2, neighbourhood unit planning is an approach to road planning that deliberately restricts the freedom of motorists to match trip origins and destinations, by limiting the number of roads that can be used for travel, in accordance with a hierarchy based on throughput capacity. In its initial iterations, neighbourhood unit planning was never intended to restrict the ability of other modes, such as pedestrians and cyclists, to travel; indeed, one of the arguments used in favour of it was its capacity to calm motor traffic for the benefit of the walking and cycling public.

In the Valley, this system has impacted on the lives of the respondents in significant ways. Respondents from Masiphumelele revealed in their discussion, and in their mapping, that a system of locked gates and fences operated to make free movement in and out of their community impossible, whether on foot or by bicycle, and to prevent easy access to the major destination of the Long Beach Mall and its taxi rank.

Figure 40 illustrates the deviations involved in the commutes of two respondents from the MS2 group (the same commutes are presented in more detail in Figure 56). Both routes show the effect of the continuous barrier of fences and perimeter walls that make passage on foot or by bicycle between low-income Masiphumelele and middle-class Sun Valley impossible along a distance of some 1600m. This barrier is reinforced by a locked gate, as shown, that prevents access between residential Sun Valley and the Long Beach and Sun Valley Malls. Absent this gate, Masiphumelele residents would still be forced to exit Masiphumelele onto Kommetjie Road, but could then use lower-stress routes through residential Sun Valley to reach the taxi rank at the Mall. The effect of both types of restriction increase the distance of the Blue commute by 36%, and mean that 17% of this journey is along the high-stress Kommetjie Road. The Red commute deviates from a no-restrictions alternative by 26%, and 21% of this is along Kommetjie Road. It is significant that both of these deviations are above the 25% maximum

Figure 40: Mapping of routes taken by Masiphumelele respondents, showing deviations



In this excerpt from mapping done in the MS2 group, an extreme degree of deviation is evident. These journeys are analysed in Figure 36. The red dotted strip is an enhancement of one respondents' daily commute, showing a clear preference for leaving Kommetjie Road as soon as possible, in order to benefit from routes that are less direct, but also less stressful (in the sense of the LTS model in Section 2.6.1). Another respondents' route, in blue, shows even more deviation, as he manoeuvres through a system of informal barriers preventing direct access through a middle-class suburb.

specified in the Welsh CEAT, meaning that these commutes would qualify, in Wales, for priority status for cycling investment. Moreover, absent barriers and gates, no section of either commute would include Kommetjie Road, allowing both commutes greater freedom of choice in their wayfinding.

Respondents did not offer speculation on the reason for the locked gate and continuous barrier, but it is likely that the way these obstacles combine to affect commuters from Masiphumelele is not accidental. I contend that they belong to the toolkit of what Schuermans (2016) calls 'enclave urbanism', of which gated communities are the most widely known manifestation. In this case, the barrier and the gate enact an enclave in Sun Valley, which passively polices the movements of Masiphumelele pedestrians and cyclists. By denying this group of captive pedestrians and cyclists even the right to free passage through the enclave, these commuters are also forced onto the shoulder of a road so hazardous that it routinely and predictably results in death and injury to some of their number. This condition is compounded by the fact that Masiphumelele's estimated 38,000 residents[11] depend on one single carriageway, with a 1m-wide sidewalk, for all vehicular access to the outside.

Network effects were experienced in a different way by residents of Ocean View (see Figure 46 and Figure 50). For them, deviation was much less pronounced, as Ocean View is almost 3km further along Kommetjie Road. For these respondents, it is rather the nature of Kommetjie Road (as the only through-route in the network) that is significant. In particular, respondents referred to a 'crime corridor' (see Network effects were experienced in a different way by residents of Ocean View (see Figure 46 and Figure 50). For them, deviation was much less pronounced, as Ocean View is almost 3km further along Kommetjie Road. For these respondents, it is rather the nature of Kommetjie Road (as the only through-route in the network) that is significant. In particular, respondents referred to a 'crime corridor' (see Network effects were experienced in a different way by residents of Ocean View (see Figure 46 and Figure 50). For them, deviation was much less pronounced, as Ocean View is almost 3km further along Kommetjie Road. For these respondents, it is rather the nature of Kommetjie Road (as the only through-route in the network) that is significant. In particular, respondents referred to a 'crime corridor' (see existing along the desire lines that follow the contours of the slope between Capri Village, a middle-class, mainly White suburb, and Ocean View.) existing along the desire lines that follow the contours of the slope between Capri Village, a middle-class, mainly White suburb, and Ocean View.) existing along the desire lines that follow the contours of the slope between Capri Village, a middle-class, mainly White suburb, and Ocean View.) existing along the desire lines that follow the contours of the slope between Capri Village, a middle-class, mainly White suburb, and Ocean View.

This isolated stretch of open land attracts much foot traffic during the day, for a number of reasons:

- Kommetjie Road lacks a sidewalk or street lighting on this side, making it risky to walk along in low-light or low-visibility conditions;
- there are few crossings to the safer side of Kommetjie Road; motor traffic is fast and constant;
- this route is slightly shorter than the road, and much quieter.

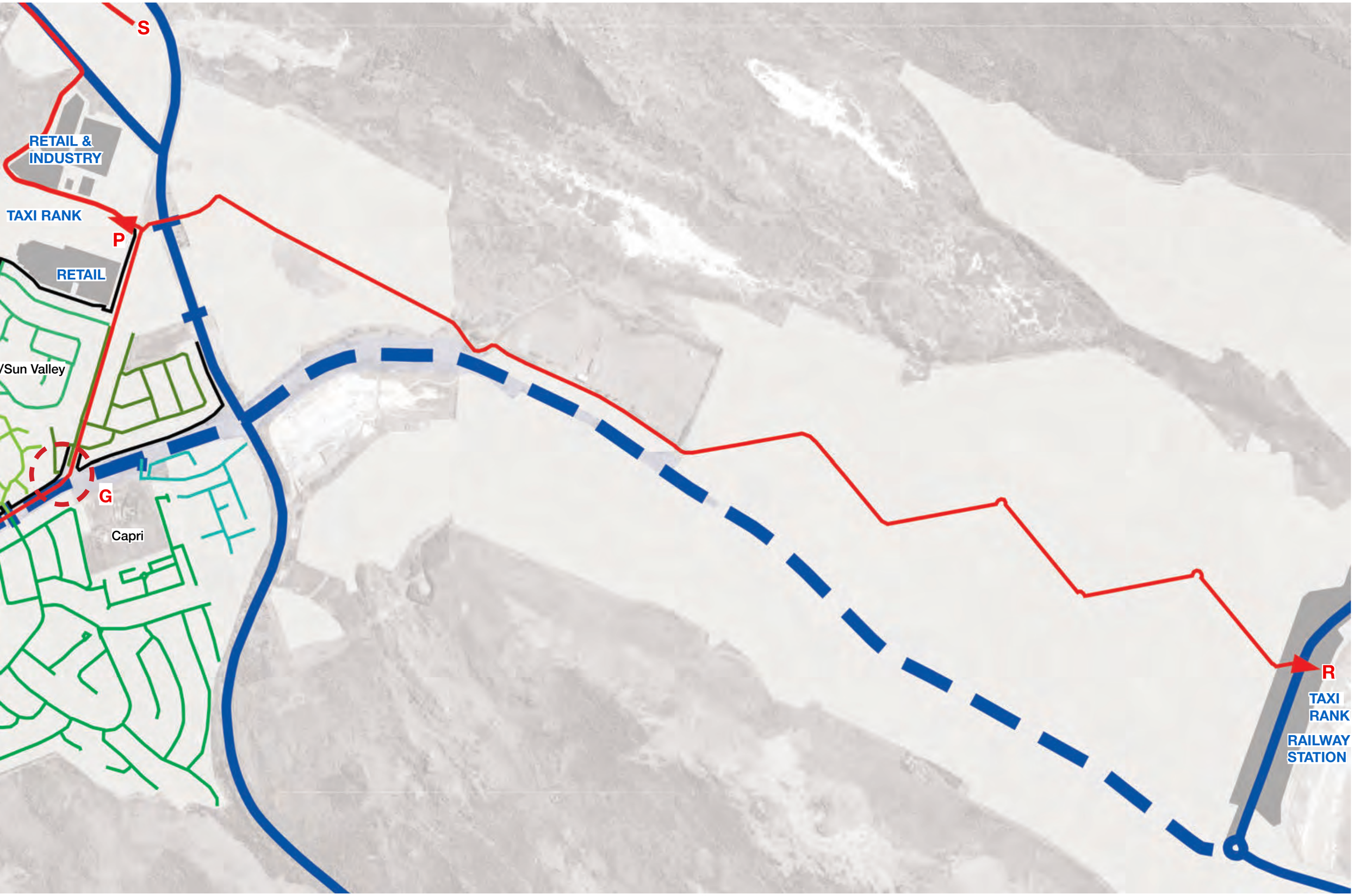
As a desire line, this route represents hand-made transport infrastructure that responds to an hitherto unmet need. However, respondents point out that the choice facing those who walk from Ocean View to Fish Hoek[12] is between the crime and injury hazard from cars along Kommetjie Road, and the crime and injury hazard from criminals along the desire line. Discussing what he called a "crime hotspot", a respondent in the OV2 group said, "I can assure you those people travelling through here [referring to the desire line] are armed. If they want to take your bike or whatever, they are going to take it" (02.09.2016). Along Kommetjie Road, cycling and walking are rendered risky by the

11 This estimate, provided by Masicorp, an NPO operating in the community on a daily basis, far exceeds the official Census 2011 estimate (Kretzmann, 2016).

12 'Fish Hoek' as a destination is here taken to include all the destinations that lie in this direction, such as the Long Beach Mall and taxi rank.

Figure 44: Deviation, Barriers, Limited-Through-Traffic Road Layout and Risk for cycle commuters from Masiphumelele

This diagram shows commutes recorded during focus group sessions in Masiphumelele. Three commuters, 'R', 'P' and 'S', begin their journeys in Masiphumelele. In order to reach their respective destinations, all are forced to use the shoulder of Kommetjie Road, due to the barrier that the area marked 'Industry', as well as the informal barriers around 'Sunnydale/Sun Valley', pose for these commuters. A 'Crime Corridor' similar to that in Ocean View (Figure 50) is formed at Intersection 'C' (all intersections correspond with those in Figure 18). Here, respondents fear to walk after dark, as the row of industrial firms along this road keep normal business hours. When they close, continuous barriers on both sides of Abington Road make this a dangerous place to walk (MS2 10.09.2016).


S
RETAIL &
INDUSTRY
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RETAIL
/Sun Valley
G
Capri
R
TAXI
RANK
RAILWAY
STATION

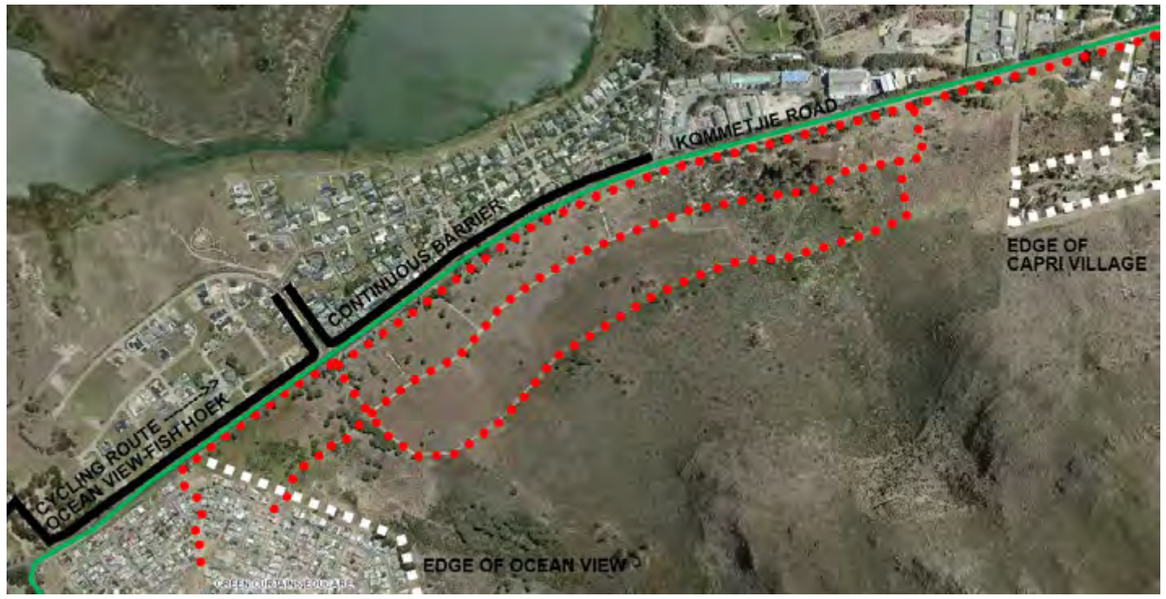
absence of stops for traffic, resulting in high speeds, low levels of street lighting, and the presence of a 1600m-long stretch of continuous perimeter walls, surmounted by an electric fence. This fortified edge to the narrow Kommetjie Road sidewalk faces a steep bank on the other side of Kommetjie Road, along which shrubs and bushes grow thickly, further obscuring activity along the desire line a little higher up the slope. A respondent from the M2 group said of this stretch:

> "Where it's dark, it's bushy. There are no buildings and there are no streetlights, so it makes you more unsafe. You can literally see when you are driving - you are cycling this side, you can see some people are sitting there inside this forest, but you get scared…[you wonder] why they need the forest, the bad guys"
>
> (MS2, 10.09.2016)

As Figure 4-26 shows, the profile of the street provides persons on the slope with a good vantage point over the road, while people cycling or walking along the sidewalk of Kommetjie Road (which only exists along the left side of the sketch in Figure 56) have shorter lines of sight, and no lateral exits from this route, due to the 'continuous barrier' (see Figure 55).

Effects such as these, which feature prominently in respondents' descriptions of this particularly hazardous section of Kommetjie Road, are captured in two CEATs: the London Cycling Guidelines criteria 'Presence of 'ambush spots'' and 'Risk/fear of crime'; and the South African PEAT's 'Open Space or Empty Lots' (see Table 2-3. It is interesting that the UK tool criteria include specific reference to crime, while in the South African tool, the presence of open space itself is automatically negative, and leads to a deduction in walkability score. In the case above, for example, the problem perceived by respondents arguably lies not in the openness of the upper verge of Kommetjie Road, but in the possibilities it offers for concealment, combined with the absence of any alternative route to meet the travel needs of many thousands of Ocean View and Kommetjie Village residents.

Figure 46: Ocean View 'Crime Corridor', as mapped in session OV2 (03.09.2016)



Another key aspect mentioned in the extract above is that "there are no buildings" (MS2, 10.09.2016). This highlights a fundamental network effect that shapes mobility in the Valley. Namely, the fact that Kommetjie Road is one type of route to motor traffic, and another kind to NMT traffic. For cars, due to the strictly hierarchical neighbourhood unit planning in the Valley, Kommetjie Road is, outside of Fish Hoek proper, a limited-exit arterial road, buffered from built-up areas by road reserves that must, to preserve lines of sight, remain free of buildings, and are bounded by perimeter walls, fences or open land. Yet in NMT terms, Kommetjie Road is a major thoroughfare for constant foot and wheel traffic, requiring the sort of physical environment that is shaded and cool during the day, and well-lit at night,

Figure 47: Profile of Kommetjie Road near Imhoff's Gift [Source: Author's Research Journal]

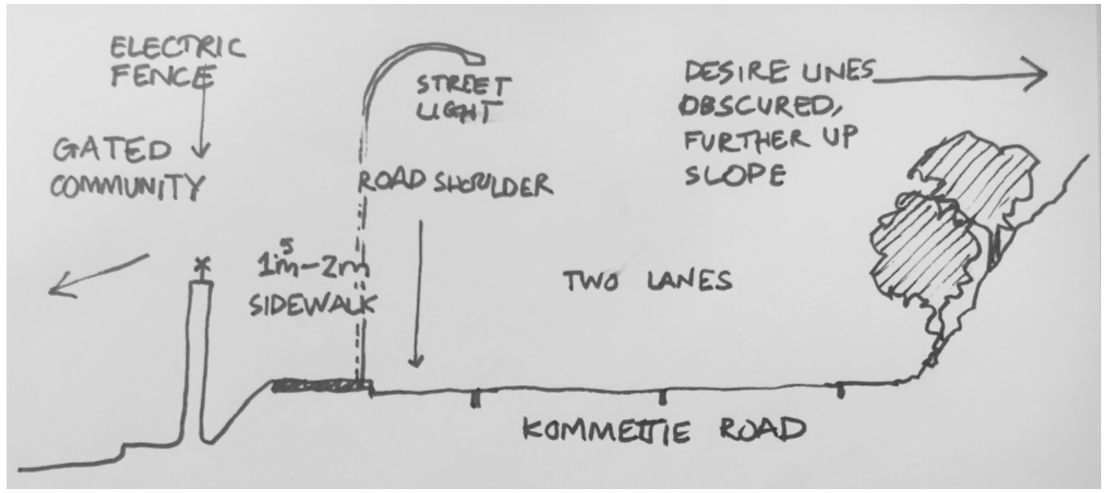
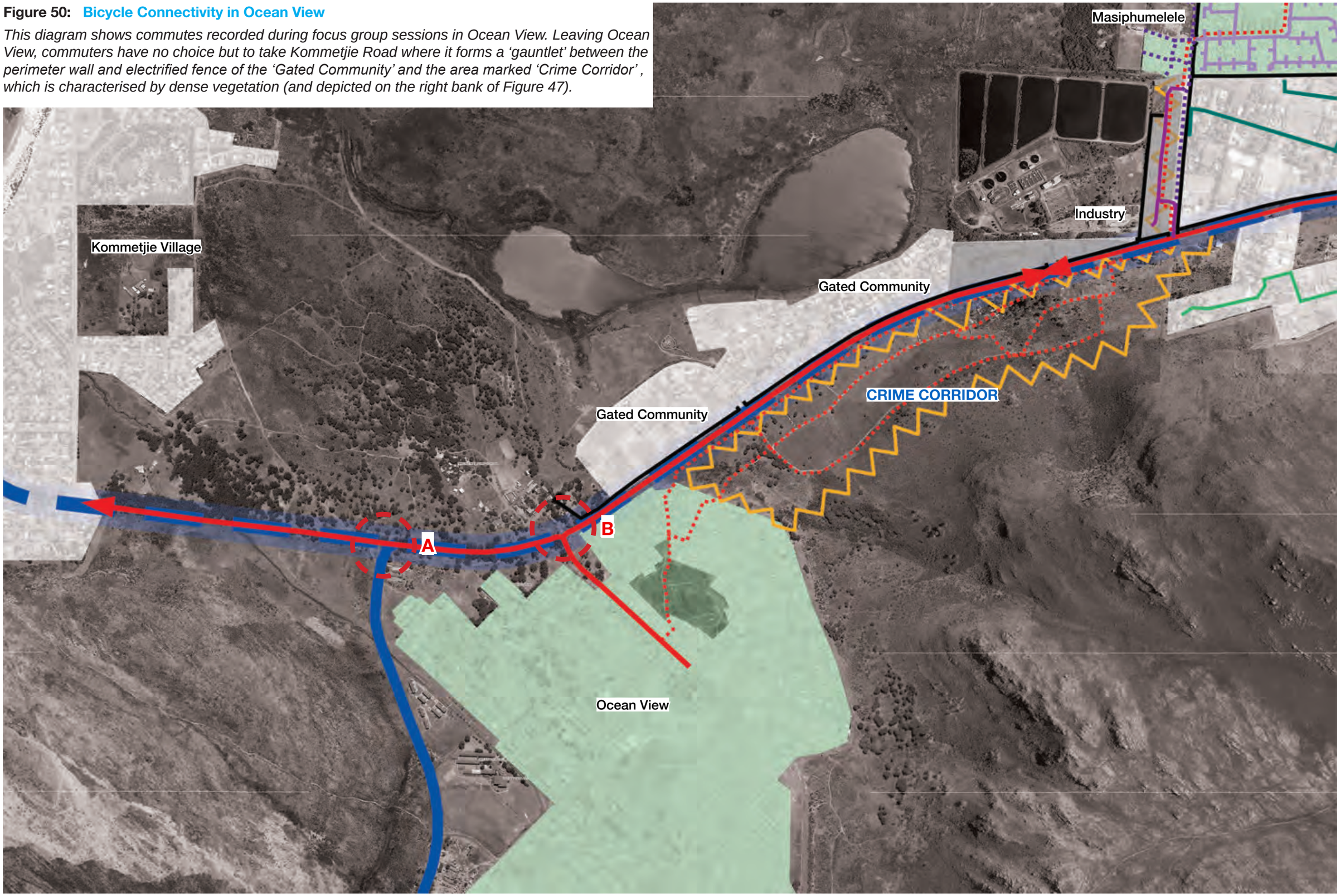


Figure 49: Kommetjie Road is at once a mobility route, for motor vehicles, and an access route, for people walking and cycling.

Figure 50: **Bicycle Connectivity in Ocean View**

This diagram shows commutes recorded during focus group sessions in Ocean View. Leaving Ocean View, commuters have no choice but to take Kommetjie Road where it forms a 'gauntlet' between the perimeter wall and electrified fence of the 'Gated Community' and the area marked 'Crime Corridor' , which is characterised by dense vegetation (and depicted on the right bank of Figure 47).



with maximum surveillance and social safety through activity at all times. This dichotomy is captured daily in scenes such as those in Figure , where large volumes of foot and bicycle traffic can be seen passing alongside traffic that can move at freeway speed.
For residents of Fish Hoek, and for the 35% of Ocean View respondents who are car-owners, network effects are primarily experienced as effects on other motorists, such as rat-running, and in the vulnerability built into the entire network through its dependence on a single connector. The latter factor has meant that unrest in Masiphumelele, when it resulted in the closure of Kommetjie Road, would effectively cut off Ocean View and Kommetjie Village from the rest of the city[13]. As a retired male respondent from FH1 stated,

> "If they want to riot, they just close off everything; they will throw containers across the road, they burn logs and trees and tires at every intersection…[Kommetjie Road] is a political minefield".
>
> (FH1, 17.08.2016)

The limited-access design of arterials such as Kommetjie Road and Ou Kaapse Weg also affected taxi drivers' decisions. At peak times, taxi drivers aiming to reach Fish Hoek Station and its taxi rank from Ocean View and Masiphumelele tended to use 'rat runs', such as Frigate Crescent, as a way of circumventing congestion. On one occasion, I passed a protest mounted by local residents against this (see Figure 51).

Several respondents from Fish Hoek, all of whom were retired men, mentioned that rat-running was a deterrent on some of their most-used routes. This view was corroborated by the two female pedestrian cyclists, who highlighted the positive aspect of the Valley's strict road hierarchy. As one respondent argued, the fact that through traffic was deliberately limited to Kommetjie Road left residential routes quieter than they would be in a highly permeable network, keeping residential areas calm and peaceful. shows, pedestrian cyclists must accept a deviated route as the trade-off for lower stress. None of the respondents in this study mentioned a desire to see direct routes for cyclists combined with traffic calming along limited through-routes for motorists, possibly due to the fact that this combination is rare in the Valley and difficult to imagine for residents at present. However, both sets of Masiphumelele cyclists regularly used the only residential filtered permeability link in the Valley, although they did not describe it as such. This connection is shown in Figure 53. According to a local government official who attended the FH2 group, these links were constructed in the 1970s as part of a scholar transport programme. They presumably occur only within Fish Hoek as they were only built within then-White areas. As Figure XX shows, respondents from both the MS1 and MS2 groups recorded commutes that use this link, which combines with a cycling-and-pedestrian only bridge to facilitate cyclists' use of a quieter alternative to Kommetjie Road.

4.6.7 Sidewalk + Verge

Sidewalks and verges (referring to the character and condition of the space abutting the roadway) are an integral part of cycling in the Valley, according to respondents' experiences. This is especially due to the always contingent nature of cyclists' right to the road. Among all respondents, only the most experienced, with decades of cycling practice, did not mention strategies for leaving the roadway and moving onto the sidewalk when necessary. All other respondents frequently mentioned strategies for using the sidewalk and verge as an extension of, or alternative to, the roadway (ref). If, as the respondents' experiences suggest, there is a very low general level of trust that motorists will obey road laws, a detailed assessment of the condition of the sidewalk and verge is essential to evaluating the cycling environment. This section discusses aspects of the built environment beyond the roadway that focus group participants referred to in their narratives, and concludes with a comparison between these elements and the criteria mentioned in the CEATs in Table 2-3.

13 In practical terms, for cyclists. Motorists able to afford the expense have the option (except during veld fires) of a 35km detour via Scarborough and Simonstown; several respondents from Ocean View and one from Fish Hoek had done this before.

Figure 51: Residents' protest against rat-running

Residents' on-street protest attempting to block passage by taxis, Firgate Road, 06.09.2016

An anti-ratrunning protest blocks a Class 1 cycle facility, Corsair Road, 06.09.2016

Figure 52: Pedestrian cyclists' routes, as an alternative to Kommetjie Road

The commute shown at left is that of a female pedestrian cyclist, who only cycles on routes that allow her to avoid arterial roads (FH1, 17.08.2016)

Arguably the most vulnerable group among all respondents were the older women in the FH1 group who described themselves as 'pedestrian cyclists'. While a majority of respondents resort to riding on sidewalks on an ad hoc basis, pedestrian cyclists often depend exclusively on the quality and condition of the sidewalk as their cycling corridor. These cyclists thus avoid the hazards of the motorised roadway, but are constrained by the low status accorded to walking, and to the walking corridor, in public life. A recurring theme among pedestrian cyclists, as well as other respondents who used long, fast sections of Kommetjie Road, was the fact that sidewalks were often treated as non-essential transport infrastructure. Respondents from all three communities mentioned a range of pretexts upon which sidewalks were routinely rendered impassable.

For example, the FH1 group commented that the way in which roadworks were managed between Fish Hoek and Kalk Bay were such a deterrent that she would rather walk than cycle there, because "it's just impossible to find a place" (ref, date). This account was amplified by another female pedestrian cyclist who argued that she is "more off the bike than on". These comments suggest a lived experience of automobility in which only the roadway, where motor vehicles move, carries real traffic, while the sidewalk, and walking environment, is treated as leftover space.

An experienced male cyclist from the FH2 group stated that, where cycling lanes had been designated on sidewalks, the facility often failed in the details. This is something that current CEATs may not capture, and could perhaps only be tested through verification of whether the presence of a cycling facility actually results in cyclists using it. For one experienced male cyclist from the FH2 group, for example, a cycle path near the Sun Valley traffic lights (shown in For example, the FH1 group commented that the way in which roadworks were managed between Fish Hoek and Kalk Bay were such a deterrent that she would rather walk than cycle there, because “it’s just impossible to find a place” (ref, date). This account was amplified by another female pedestrian cyclist who argued that she is “more off the bike than on”. These comments suggest a lived experience of automobility in which only the roadway, where motor vehicles move, carries real traffic, while the sidewalk, and walking environment, is treated as leftover space.) was seldom used because “the pole for the robot is in the middle of the cycling path…[so]…people just stay off the cycle path”.

In the study area, pedestrian infrastructure, such as the paved or unpaved sidewalk, is regularly used for the storage of roadworks equipment and machinery, for the parking of cars and erection of temporary and permanent billboards and signage, and for the erection of hazardous electrical infrastructure. Civil engineering works, such as piping – and especially, in recent years, new-generation IT infrastructure – is routed under sidewalks, meaning that the loss of sections of the pedestrian realm is a constant of walking for transport. These experiences were summarised by an experienced female cyclist in the FH2 group with decades of experience in local government:

> “I would really like to see that our engineers, our roads depot guys… the labourers…take cognisance of cyclists…prams and wheel chairs. Because we have a lot of those too and we just don’t think what we do. You know, we put bollards up in the middle of pavements, we don’t drop kerbs so people can go off the sidewalk and into the road when necessary. When we repair potholes, we’re just not considerate. They don’t even think about it. They don’t think about the cyclists. We do road work and we just spill everything out into the whole lane and there [gesturing towards the roadside] is just nothing.”
>
> (FH2, 23.08.2016)

This excerpt, from a respondent who is uniquely positioned to understand the needs of cyclists and the possibilities of local government, is instructive. It alludes to the invisibility of non-motorised traffic (“we have a lot of those and we just don’t think that we do”). The extract also refers to the way in which the sidewalk is made to serve the interest of motorists. Bollards, designed on the premise that motorists will disobey parking laws unless physically barred from doing so, ‘protect’ the sidewalk while obstructing and narrowing it, as do speed cameras, large road signs and refuse bins. As the same respondent added later,

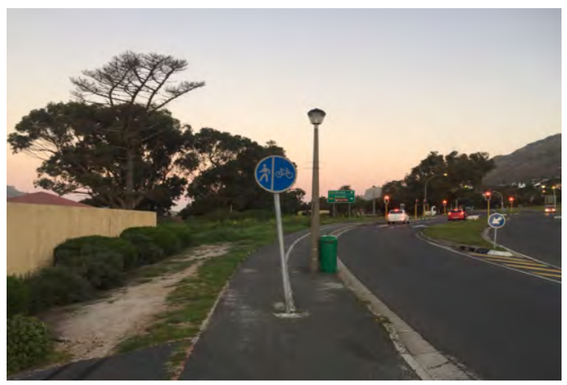
> I think if we are talking about a culture thing, we need to instil in our roads depot and with our district engineers the importance of a seamless transition between a rising main, or a storm water pipe, or a hydrant valve, or all those things, because very often there is a dip to go over that can throw you, or it is up above and it hits you and it breaks your wheel.
>
> (FH2, 23.08.2016)

This point further reinforces the central theme that, where the roadway is concerned, a smooth and functional level of service is only guaranteed along the parts designated for motorised traffic. The road shoulder or edge, where cyclists must ride, is not an equal part of the roadway, but a margin in which maintenance functions constantly supersede transport functions, as with the grates and gullies referred to above. The issues raised in these focus groups are fully covered in the CEATs, under the Pavement Condition section (‘Presence of drainage grates, sunken covers or gullies’), but as the extract above shows, these are not in themselves a hazard, provided that transitions are “seamless”[14]. A lack of dropped kerbs bars many classes of cyclist from using sidewalks without

Figure 53: A major instance of filtered permeability within a residential area of Fish Hoek

Figure 54: Extracts from respondents’ commutes from both Masiphumelele sessions, showing use of a filtered permeability connection

Figure 55: A centrally placed cycling/pedestrian sign narrows the effective width of the sidewalk to less than 900mm



14 Meaning that the camber of the road edge is designed to be cycleable without incident

Figure 56: The pedestrian realm is rendered impassable whenever doing so simplifies roadworks or assists motorists

At left: roadworks render the sidewalk impassable, forcing pedestrians into an arterial road, Kommetjie Road. At right: a pedestrian crossing on Kommetjie Road (near 9th Avenue). The distance between the redundant pole in the foreground and the facebrick wall is 900mm.

dismounting at every cross-street[15]. Lastly, the extract mentions that roadworks are often a pretext to "spill everything out into the whole lane", which once again positions the pedestrian realm as subservient to the roadway, liable to be rendered impassable whenever this is useful for roadworks. Field trips to the Valley corroborated this tendency, which is a common feature within the Metro area as a whole. Despite the status of walking as a major mode of last-mile transport in Cape Town, "engineers" and "road depot guys" seldom phase roadworks on the sidewalk so as to preserve passability, which is common practice on the roadway.

In addition to being a spill-over space for any surplus maintenance functions of the roadway, sidewalks in the Valley are also designated as permanent parking spaces for motor vehicles. As a male retiree from the FH1 group remarked, "another added problem in Fish Hoek, [is] parking on the pavements. [It is] actually demarcated where they can, and now they come and they park right up to their wall" (FH1, 17.08.2016). This erasure of the pedestrian realm in residential neighbourhoods was repeated on arterial roads outside of built up areas. As a confident female cyclist from the same group stated, "…A lot of people used to feel safer cycling on the sidewalk on Boyes Drive. And now they can't, because the cars [are parked there]. And it has given the vehicles more space on the road" (FH1, 17.08.2016). Figure 57 illustrates some of these phenomena with examples from the Valley and the metropolitan area. Both images depict the sidewalk of Kommetjie Road. To the left, signalling poles and warnings for motorists combine with a redundant pole in the foreground to narrow the effective sidewalk to 900mm, creating a pinch point that would force cyclists to dismount. On the right, a short distance further, the entire sidewalk is blocked by unsignposted roadworks, forcing cyclists (and wheelchair users) to pass into the roadway, around a parked car, and then mount the sidewalk again on the other side. CEAT tools do not measure temporary phenomena such as roadworks, but the fact that bulk services run under sidewalks means that alterations to them are a constant and predictable feature

15 This is captured in respondents' comments that bicycles without suspension are generally not able to withstand 'pavement hopping' as a standard riding mode. 'Pavement hopping' is also a technique that becomes hazardous at low speeds, and thus excludes less vigorous riders, such as older people or those carrying loads.

Figure 57: Obstruction of sidewalks through central fixing of roadsigns

of the walking and cycling environment. In the Valley, the choices taken by 'engineers and road depot guys', means that this amounts to the routine obstruction of cycling and walking rights of way. A CEAT that responds to conditions in the Valley should therefore incorporate a measure of how roadworks are managed; without this, both Kommetjie Road sidewalks shown in Figure 56 would score highly in both cycling and walking terms. Figure 57 illustrates two more examples from the suburb of Claremont, served by the same roads depot as the Valley. These examples show that the problem extends beyond the study area.

In this way, the experience of pedestrian cyclists, such as the two women in the FH1 group, is instructive. Unable to use the roadway that they are entitled to (and restricted to) by law, due to a statistically well-founded perception of physical risk, these cyclists limit themselves to the sidewalk, thus assuming the status of pedestrians, and thereby an additional form of marginalisation. As cycling infrastructure in Cape Town is highly fragmented, with few continuous routes (Jennings, Goldman & Petzer, 2016), cyclists who travel beyond their immediate neighbourhoods must alternate – often under duress and at full speed - between sidewalk, roadway and sections of dedicated cycling facility. As the excerpt above demonstrates, "automobility" is present in the public realm of the Valley, since traffic that is not wheeled and motorised is invisible, something "we just don't think about". For this reason, any CEAT adapted to local conditions must also assess the permanent effective[16] layout of the sidewalk and verge to a level of detail comparable with the roadway.

In the MS2 group, respondents stated that the factors most often responsible for their decision to move from the roadway onto the sidewalk were traffic volume and speed. This corroborates a common factor among many of the CEATs, including all those from the USA, that are based on these two factors as the primary determinants of the cycling experience, and weight them heavily:

16 'Effective' here is a reference to the National NMT Guidelines (Vanderschuren et al., 2014), which recognize that cyclists require an operational clearance around and above them that varies with speed.

Interviewer: When do you cycle in the road and when do you cycle on the pavement?
Respondent 1: We are going on the road…
Respondent 2: I can say sometimes when the road is busy, then you're going on the pavement. Because it's too busy. When you are going to Kalk Bay, the road is too small now, so I have to cycle on the pavement.
Interviewer: Do you ever go onto the pavement because you feel the traffic is too fast?
Respondent 1: Between Masiphumelele and Fish Hoek, the taxis are too fast.
Respondent 2: During peak hour…it's not easy to cycle [from Masiphumele to Kommetjie Road]
Interviewer: OK, so you cycle on the pavement when there isn't space on the road?
Respondent 1: Enough space, yes.

(MS2, 10.09.2016)

While space on the road is often limited, cyclists experience a lack of space on the sidewalk too. Among the CEATs, only the London and Wales tools – with their generally stronger focus on 'soft' factors – contain measures for conflict between cyclists and pedestrians, under negative criteria such as: 'Does cycling lessen level of service for pedestrians?', and 'Is sidewalk shared between cyclists and pedestrians?' (see Table 2-3). Among the focus groups, respondents from Masiphumelele and Fish Hoek commented on conflicts between walking and cycling. One cyclist from the MS1 group stated that, on the crowded peak-hour sidewalk and road shoulder between Masiphumelele and the Sunnydale NMT route, cyclists and pedestrians negotiated who would yield to whom on an ad-hoc basis. In the most heavily-used sections of Kommetjie Road, neither the walking, riding or driving public can expect to move through dedicated corridors without interference from other modes. Pedestrians and cyclists must watch for motor vehicles ramping up onto the sidewalk to overtake congested traffic. Pedestrian flows in both directions must accommodate wheelbarrows, wheelchairs, trolleys and other freight. Cyclists passing in both directions, including in contraflow along the road shoulder, must yield to each other, to overtaking vehicles, and to groups of pedestrians.

The street scenes here reflect a degree of informality that is not captured adequately in any of the CEATs. The mobility regime here is essentially pragmatic, and much of it falls outside current South African law. This is because it diverges greatly from what the physical attributes of the corridor have been designed to support. CEATs focus heavily on the measurement of physical attributes, and none of the criteria in Table 2-3 measures the behaviour and strategies of pedestrians and cyclists on their own terms. From the figures it is clear that the walking and cycling public, and to an extent the driving public, have re-scripted a piece of the public realm with new strategies that make sense within the context of their daily commutes, and have claimed the space for these strategies simply by enacting them collectively in the roadway. My personal experience suggests that cyclists riding contraflow elsewhere in the city could expect to provoke strong reactions from motorists and, potentially, traffic law enforcement, as this practice is illegal. However, contraflow riding is an accepted part of Kommetjie Road's mobility culture, which I observed on every one of my site visits[17]. Further, respondents' discussions of this practice were mostly negative. For example, one frustrated Masiphumelele respondent stated that:

"On the [sidewalk], it's for the pedestrians walking on that one, so you cannot jump where the pedestrians are walking, and at the same time you cannot see where the yellow line [for cars is], and which is the side of the cyclists" (MS1, 03.09.2016).

Another respondent, from the MS2 group, described this route as requiring "risky manoeuvres" that had resulted in a collision (ref, date). A respondent from Ocean View said, of the need to leave the roadway and mount the sidewalk,

17 Contraflow lanes are also an accepted part of cycling facility provision, and are discussed in the London and Wales CEATs, as well as the 2014 Bikeway Design Guide (NACTO, 2014). However, in each of these resources, they are solely recommended for streets in which motorised traffic is one-way.

Figure 58: The Negotiated Roadway – informal strategies for road use at the Capri Intersection

A narrow 1.8m-wide pavement, which is cracked and broken, supports (and is fully occupied by) heavy pedestrian traffic and the trading activity that this attracts. In the middle of the image, a cyclist rides in contraflow down the oncoming lane.

Figure 59: The Negotiated Roadway – informal strategies for road use at the Masiphumelele Intersection

As motorised traffic slows down at peak times, the dynamic envelope of vehicles shrinks, allowing other modes to safely pass vehicles and re-appropriate the road shoulder for contraflow cycling and walking, while the verges and verge-side sidewalk edge become a social and informal trading space.

"I've tried a few times to cycle on there, but obviously every time there's pedestrians [on the sidewalk], I go off. And sometimes I go off onto the rough side, the actual grass. But to get on and off all the time is also not so safe. Because each time I go down into the road I could fall. I could come into... A car could be, you know, passing, double overtaking"

(OV1, 02.09.2016)

This excerpt reflects the risk that cyclists perceive in this practice, and suggests that a contextually appropriate CEAT might explicitly identify practices such as these as the strategies of cyclists and pedestrians held 'captive' to a single side of a single arterial, with there being no alternative route of any kind.

4.6.8 Conclusion

The responses discussed in this chapter reveal that cyclists in the Valley employ a wide range of strategies in order to travel safely by bicycle. Within this sample, differences of race and income level did not appear as significant determinants of cycling practice, except in deciding where cyclists are able to live. Gender, however, was revealed as a major determinant, since 2 out of a total of 4 female

respondents (among 36 focus group participants) were also the only pedestrian cyclists in the study. The largest indicator, with an influence on almost every 'Hard' factor, is home neighbourhood. Residents of Fish Hoek are able to enjoy freedom of movement and a range of alternatives to arterial routes, and their ability to cycle is relatively less constrained as a result. In contrast, cyclists in Ocean View are not able to leave their home neighbourhood by bicycle unless, and until, they acquire the confidence and skill needed to ride along a fast and statistically hazardous arterial road. For Masiphumelele residents, this effect is even more marked, since the area lacks a high-quality internal road network, a working signalised intersection with Kommetjie Road, and comprehensive internal street-lighting. Perhaps the most striking finding was that residents of Masiphumelele are forced to make detours along Kommetjie Road, thereby risking injury, because of the system of barriers and road closures that prevent them from travelling through middle-class suburbs to reach key destination clusters. It is clear from these responses, as well as from Ocean View residents' discussion of the 'crime corridor' between their neighbourhood and Capri Village, that 'soft factors' such as the perception of crime greatly distort cycling practices, and movement in general, within the Valley. The following chapter will discuss how the variety of determinants brought to light in respondents' accounts might be incorporated into a CEAT that is contextually appropriate to the study area. This takes the form of various recommendations put forward, both for further research, as well as for policy and infrastructural intervention.

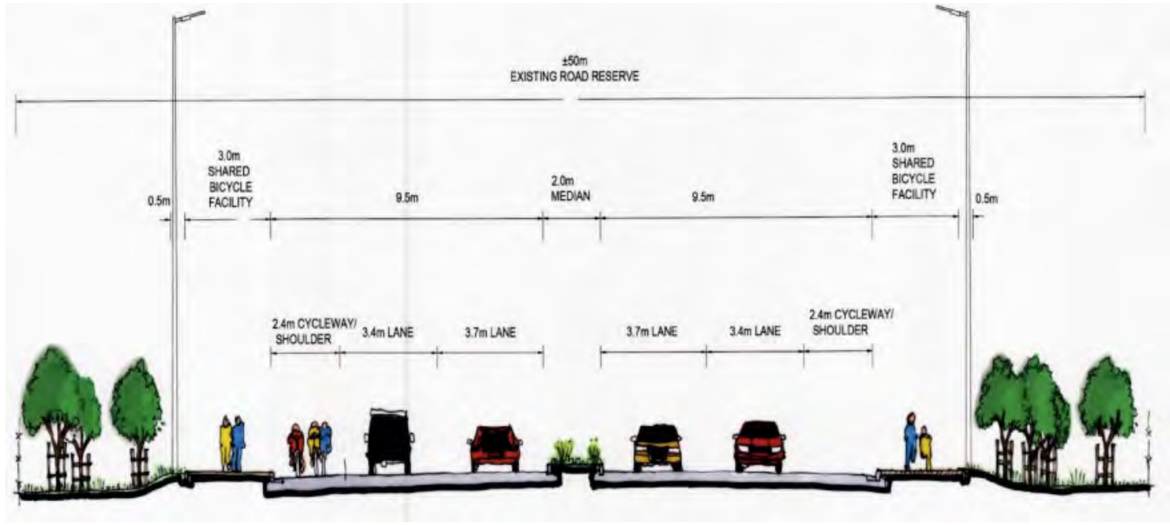
4.7 Déjà Vu, Déjà Survécu[18]: the instant obscolescence of Kommetjie Road's new bike lanes

The first of these is the degree of contestation surrounding mobility in the Far South in general, and motor vehicle traffic along Kommetjie Road and Ou Kaapse Weg in particular. Interviews with participants pointed to community resources, such as the newsletters of community organisations, that detailed a history of organised opposition to further property development in the Valley, to a perceived legacy of underinvestment in transport infrastructure, and to the City government's perceived indifference to local concerns. During the course of the study, the situation on the ground changed rapidly.

At the time of writing, a local residents' association has taken the City of Cape Town to court in a bid to overturn recently approved residential development. One of the claims made by the backers of this campaign is that the already severely congested traffic situation in the Valley will deteriorate further if new development is allowed. A common thread in the publications of community organisations such as the Noordhoek, Kommetjie and Fish Hoek residents' associations and their umbrella body, the Far South Peninsula Civic Association, is that the Valley has been a convenient place for the City of Cape Town to allow rapid development of land without the expense of a corresponding investment in infrastructure. These claims are borne out by the rapid increase in the Valley's population (Far South SEA) over a short timeframe, and its current traffic situation, which the City of Cape Town's own reports (Kommetjie Road Project Public Meeting) acknowledge to be among the most challenging in the Metro (see Figure 61 and Figure 62).

This is the charged political context in which the City of Cape Town has commenced its traffic study, which will last for 8 months; pending its completion, an Open Day is planned for the first quarter of 2017, at which it will be presented to area residents (Herron, 2016). However, one month after this announcement, in September 2016, an Open Day was held in Fish Hoek, at which the City made public a comprehensive set of plans for the upgrading of Kommetjie Road, including cycling lanes along certain stretches. Figure 60 shows a cross-section of the proposed upgrade to Kommetjie Road. In both directions, the proposed dual carriageway presents a raised, 3.0m-wide "shared bicycle facility", followed by a 2.4m-wide "cycleway/shoulder" at grade with two motor vehicle lanes, and a raised and landscaped median. This proposal is problematic for a number of contextual reasons, as the responses of the focus group participants have shown, since it depends on the will of motorists not to infringe on pedestrian or cycling space. It therefore expects motorists to behave in a

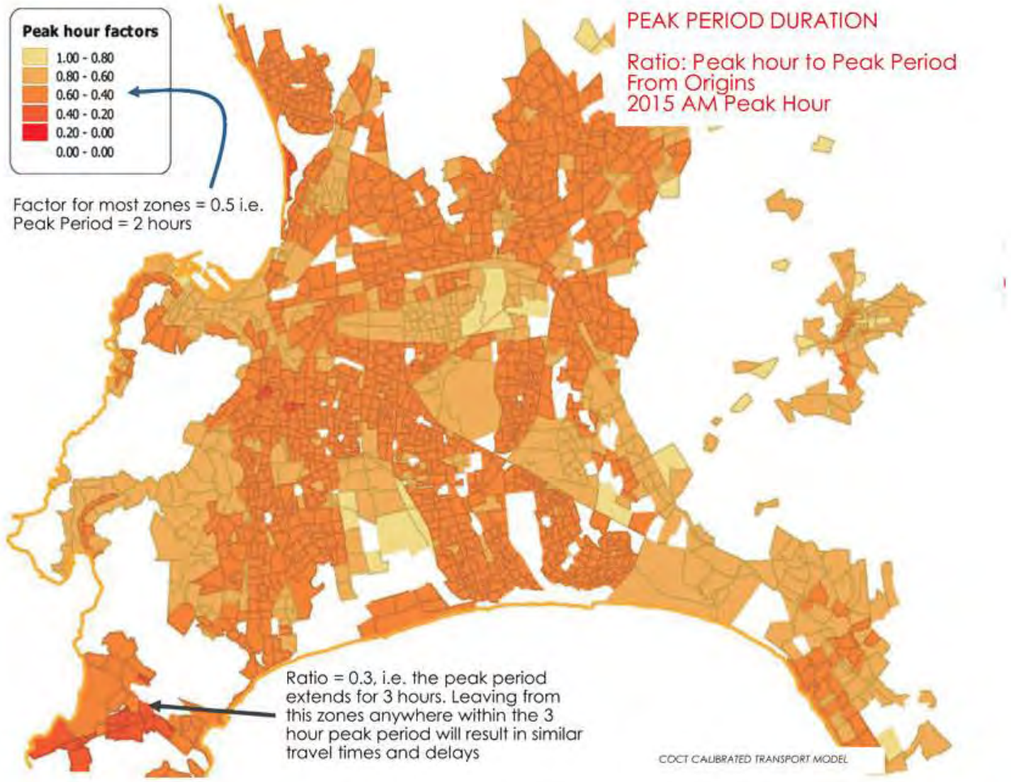
Figure 60: Section of Proposed Improvements to Kommetjie Road (Source: CoCT 2016:18)



way that runs counter to respondents' experiences in the Kommetjie Road corridor. However, it also seems to be in conflict with numerous sections of the National NMT Guidelines. Kommetjie Road is an arterial road heavily trafficked with pedestrians and cyclists throughout much of the day. As such, the NMT Guidelines recommend that NMT facilities offer either "partial" (for minor arterials) or "total" (for major arterials and freeways) separation from motorised traffic. 'Partial' here means separation at grade, such as a raised kerb sufficient to ensure that "no conflict can occur under normal operating conditions" (Vanderschuren et al., 2014:49). 'Total' means that "no conflict will occur between motorised and NMT even in the event of loss of control of the motorised or NMT vehicle", which requires a heavy barrier or lateral separation of between 1 and 9 metres in width (ibid).

The observed NMT flows along the sidewalks of Kommetjie Road suggest that pedestrian traffic is already heavily constrained by a lack of width, although the existing sidewalk is 1.8-2m wide. It is therefore unclear that an extra 33%/1 metre gain in width would successfully accommodate the existing bi-directional pedestrian traffic flow, including wheelchair users, informal traders with trolleys and wheelbarrows, and people pushing bicycles, or remove the constant need for pedestrians to step down from the kerb into the road shoulder when passing other pedestrian groups. It is even less certain whether what is called a "shared bicycle facility" will accommodate cyclists, who were routinely observed yielding to pedestrians along the crowded sidewalk by descending from the kerb and into the road shoulder, with arterial motorised traffic passing at a posted speed limit of 60km/h within a few centimetres of these road users' bodies. Added to this is the evening contraflow of cyclists riding up the 'wrong' side of Kommetjie Road, and passing on the outside of the cyclists riding the road in the legal direction [discussed in fieldwork]. The proposal above does not demonstrate that these movements have been taken into account, and – against the recommendations of the National NMT Guidelines – it offers no physical protection to cyclists' bodies whatsoever. In this it also ignores formal submissions made to previous NMT schemes for Kommetjie Road going back to 2011 (Jennings, 2012). In the language of cycling activism, it could therefore be said that future fatalities and serious injuries to the cycling and pedestrian public have been 'designed in' to what focus group users have termed a "road of death".

18 'Already seen it, already survived it'


Peak hour factors
1.00 - 0.80
0.80 - 0.60
0.60 - 0.40
0.40 - 0.20
0.20 - 0.00
0.00 - 0.00
PEAK PERIOD DURATION
Ratio: Peak hour to Peak Period
From Origins
2015 AM Peak Hour
Factor for most zones = 0.5 i.e.
Peak Period = 2 hours
Ratio = 0.3, i.e. the peak period extends for 3 hours. Leaving from this zones anywhere within the 3 hour peak period will result in similar travel times and delays
COCT CALIBRATED TRANSPORT MODEL

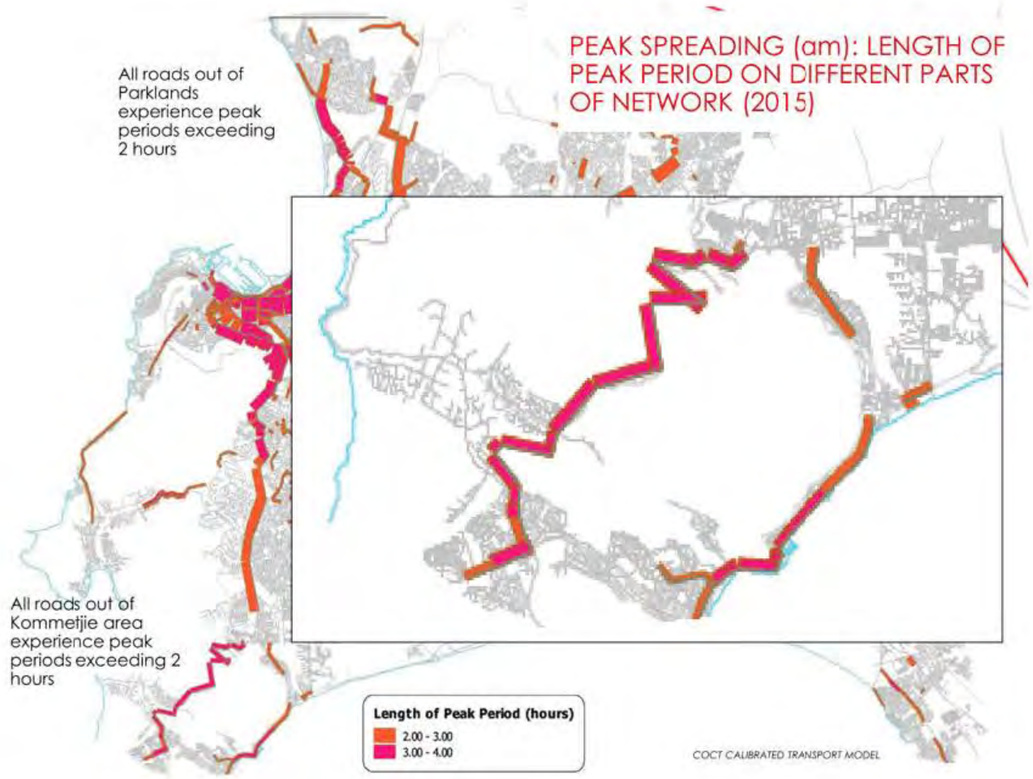

PEAK SPREADING (am): LENGTH OF PEAK PERIOD ON DIFFERENT PARTS OF NETWORK (2015)
All roads out of Parklands experience peak periods exceeding 2 hours
All roads out of Kommetjie area experience peak periods exceeding 2 hours
Length of Peak Period (hours)
2.00 - 3.00
3.00 - 4.00
COCT CALIBRATED TRANSPORT MODEL

Table 4-11: Code Occurrence Counts from Focus Discussions

A: Non-Physical Criteria

		Non-Physical	Area + Route Qualities															
	Total Respondents			Destinatio	Fish Hoek Station	Sun Valley	Fish Hoek	Fish Hoek Direction	Kommetjie Direction	Masiphumelele	Ocean View	Precedent	Social, Shopping, Errands	Animals	Lack of Law Enforcement	Political Demonstrations	Unsafe For Children	Weather
Census Group: Black African (M)	14	67	18	4	2	2		2	1	6		1					1	3
Census Group: Coloured (OV)	10	94	29	3	1			3	3	5	1	1	3		2	1	1	8
Census Group: White (FH)	12	207	30	4	1		5			4		4	3	1		1		11
Focus Group: Fish Hoek 1	9	156	21	3			5			1		1	3	1		1		9
Focus Group: Fish Hoek 2	3	51	9	1	1					3		3						2
Focus Group: Masiphumelele 1	10	34	10	1	1			1		3		1					1	3
Focus Group: Masiphumelele 2	4	33	8	3	1	2		1	1	3								
Focus Group: Ocean View 1	4	58	17	2	1			2	1	3			1			1		8
Focus Group: Ocean View 2	6	36	12	1				1	2	2	1	1	2		2		1	
		368	77	11	4	2	5	5	4	15	1	6	6	1	2	2	2	22
Featured in Composite CEAT Criteria:																		

	Cycling Behaviour							Positioning Strategies								Route Strategies															
		Bicycle Lock-Up + Parking	Bicycle, Helmet + Tools	Carrying Loads	Headspace	On Demand	Visibility + Communication Strategies		Aural Cues	Cycle on Wrong Side	Near Misses	Pedestrian Cycling	Riding Abreast	Taking the Lane	Vehicular Cycling		After Dark	Avoid Arterials	Bike-Bus Transfer	Bike-Train Transfer	Crime As Route Determinant	Deviation Necessary	Distance	Failure to Obey Signals	Fixed Routes	Only Busy Routes After Dark	Rather Taxi After Dark	Safe Within Neighbourhood	Sharing Information	Time of Day	Walking Sometimes Easier	Would Use Arterials If Legal
Census Group: Black African (M)	30	3	1			2	4	7		3		4				15				2	4	3					1	3		5	1	
Census Group: Coloured (OV)	39	4	3	1			4	11	3	4	1		2	1	1	18		6			7	1				1		2		2		
Census Group: White (FH)	82	6	5	5	5	2	7	29	4	4	1	4	3	4	5	36	3		1	3	13	8	1	1	3	1		2	1	4	2	1
Focus Group: Fish Hoek 1	66	5	4	5	5	2	2	22	2		1	4	3	4	3	29	3		1	1	10	8	1		3	1		2	1	2	2	1
Focus Group: Fish Hoek 2	16	1	1				5	7	2	4					2	7				2	3			1						2		
Focus Group: Masiphumelele 1	13	1	1			1	3	4		2		2				4				1								1		2	1	
Focus Group: Masiphumelele 2	17	2				1	1	3		1		2				11				1	4	3					1	2		3		
Focus Group: Ocean View 1	24	4	2				3	6	2	1	1		1		1	9		5			2							1		2		
Focus Group: Ocean View 2	15		1	1			1	5	1	3			1	1		9		1			5	1				1		1				
	###	13	9	6	5	4	15	47	7	11	2	8	5	5	6	69	3	6	1	5	24	12	1	1	3	2	1	7	1	11	3	1
Featured in Composite CEAT Criteria:		Y																														

	Cycling Identities + Attitudes																Driving Behaviour													Walking Behav.			
		Attitudes Towards Fellow Cyclists	Attitudes to Drivers	City of Cape Town	Confidence + Competence	Cost Savings	Female	Gender	Health Gains	Pleasure	Race	Respect for Road Rules	Safer in the Past	Utility Versus Recreational Cycling	Wider Cycling Environment	Youth		Keep Clearance	Buses + Freight	Cars	Failure to Indicate	Observing + Checking	Overtaking	Reaction to Congestion	Remaining on Roadway	Taxi	Threats	Understanding of Cycling	Yielding and Sharing the Road		Pram + Wheelchair + Trolley	Walking Risk	Walking as Deterrent
Census Group: Black African (M)	6	1			4				1							1	13		4				2	1	1	6		1	5				
Census Group: Coloured (OV)	8	2						1			2	3	1		1		18	1	4			2	2	2		7			5				
Census Group: White (FH)	55	2	2	2	2		27	2		5	5		4	4	3	2	32	4	1	5	1	1	1			9	2	7	5	8	2	4	1
Focus Group: Fish Hoek 1	47		1	2	2		25	2		5	5		2	3	3	1	20	1	1	4	1	1				6	2	2	3	2		1	1
Focus Group: Fish Hoek 2	8	2	1				2						2	1		1	12	3		1			1			3		5	2	6	2	3	
Focus Group: Masiphumelele 1	4				4											1	7		2							4		1	4				
Focus Group: Masiphumelele 2	2	1							1								6		2				2	1	1	2			1				
Focus Group: Ocean View 1	5	1						1			1	2	1				12	1	3			2	2			4			3				
Focus Group: Ocean View 2	3	1									1	1			1		6		1					2		3			2				
	69	5	2	2	6		27	3	1	5	7	3	5	4	4	3	63	5	9	5	1	3	5	3	1	22	2	8	15	8	2	4	1
Featured in Composite CEAT Criteria:																			Y			Y	Y										

B: Physical Criteria

		Physical	Intersection							Link	Legibility + Lines of Sight						
	Total Respondents			Circles	Capri Intersection	Intersection Geometry	Lack of Signals	Masiphumelele Intersection	Ocean View Intersection			Signage	Legibility + Visibility of Road Markings	Solar Studs or Cat's Eyes	City of Cape Town	No Yellow Line	Insufficient Street Lighting
Census Group: Black African (M)	14	52	4					2	2	32	5	1	2			2	
Census Group: Coloured (OV)	10	126	8		3	3	1	1		94	16	3	3	3		2	5
Census Group: White (FH)	12	145	13	3	3	3	1		3	90	5	1		2	1		1
Focus Group: Fish Hoek 1	9	74	7	3	1	2			1	32	1						1
Focus Group: Fish Hoek 2	3	71	6		2	1	1		2	58	4	1		2	1		
Focus Group: Masiphumelele 1	10	11	0							4	0						
Focus Group: Masiphumelele 2	4	41	4					2	2	28	5	1	2			2	
Focus Group: Ocean View 1	4	64	2				1	1		58	12	3	1	3		1	4
Focus Group: Ocean View 2	6	62	6		3	3				36	4		2			1	1
		323	25	3	6	6	2	3	5	216	26	5	5	5	1	4	6
Featured in Composite CEAT Criteria:						Y	Y					Y	Y			Y	Y

	Obstructions on the Roadway												Traffic Flow								Link Geometry									
		Sidewalk Build-Out	Camber	Debris on Road	Deep Culvert	Gravel Shoulder	Kerbs	Potholes	Road Surface	Speed Bumps	Traffic Calming	Rumble Strips		Car Traffic Volumes	CCTV + Traffic Cameras	Collision	Peak Traffic	Motor Vehicle Speed	Bus + Taxi Facility	Cycling Facility		Door Zone	Car Traffic Volumes	Driveways	Narrow Shoulder	Pedestrian Crossing	Pinch Points	Road Width	Shoulder	Slope
Census Group: Black African (M)	2					1	1						3	2		1			1	1	5		2			1		2		
Census Group: Coloured (OV)	15					1	1	6	5			2	4		2		1	1	3	5	8	2			3	1	1	1		
Census Group: White (FH)	14	2	3	3	1			2	3	1	1		7	1	1	4	1		4	6	13	1	1	1		1	3		5	1
Focus Group: Fish Hoek 1	3		1	1					1				5	1		4			2	4	4	1	1	1					1	
Focus Group: Fish Hoek 2	11	2	2	2	1			2	2	1	1		2		1		1		2	2	9					1	3		4	1
Focus Group: Masiphumelele 1	0												1			1					1					1				
Focus Group: Masiphumelele 2	2					1	1						2	2					1	1	4		2					2		
Focus Group: Ocean View 1	8							4	2			2	2		2				3	5	3	2			1					
Focus Group: Ocean View 2	7					1	1	2	3				2				1	1			5				2	1	1	1		
	31	2	3	3	1	2	2	8	8	1	1	2	14	3	3	5	2	1	8	12	26	3	3	1	3	3	4	3	5	1
Featured in Composite CEAT Criteria:				Y				Y		Y	Y			Y			Y	Y	Y	Y			Y	Y	Y	Y	Y	Y	Y	Y

	Network												Sidewalk + Verge							
		Barriers + Gates	Bottleneck	Perimeter Walls + Elec. Fences	Limited Through Roads	Low-Stress Routes	NMT Network	No Alternative To Arterial	Rat Run	Kommetjie Road	Main Road	Other Roads		Built-Up Areas Safe	No Roadside Buildings	Cycling Facilities on Sidewalk	Cycling-Walking Conflict	Roadside Bushes	Sidewalk Obstruction	Tree
Census Group: Black African (M)	10	1	1	2			1			5			6		1		4	1		
Census Group: Coloured (OV)	16		1	2				3		8	1	1	8				2	5	1	
Census Group: White (FH)	27				1	1		1	2	10	4	8	15	1		3	3		4	4
Focus Group: Fish Hoek 1	24				1	1		1	2	7	4	8	11	1		2	2		2	4
Focus Group: Fish Hoek 2	3									3			4			1	1		2	
Focus Group: Masiphumelele 1	5		1	1						3			2				2			
Focus Group: Masiphumelele 2	5	1		1			1			2			4		1		2	1		
Focus Group: Ocean View 1	2									1		1	2				1		1	
Focus Group: Ocean View 2	14		1	2				3		7	1		6				1	5		
	53	1	2	4	1	1	1	4	2	23	5	9	29	1	1	3	9	6	5	4
Featured in Composite CEAT Criteria:															Y	Y	Y	Y	Y	Y

Chapter 5. Recommendations towards a South African CEAT

5.1 Informal road culture and network-level effects

This study set out to answer the question of what a Cycling Environment Assessment Tool for the Kommetjie Road Corridor might look like (for ease of reading, this proposed tool will be referred to as the SA-CEAT). In doing so, CEATs from comparable contexts were surveyed and analysed, and their criteria collated into a composite list. This chapter discusses the differences between this list and the criteria mentioned by focus group respondents. Particular attention is given to factors mentioned in the focus groups that are entirely omitted from any CEATs.

The first key finding of this study is that the walking, cycling and driving public act informally as they move through the Corridor. The previous chapter has shown that driving, walking and cycling behaviour is not closely constrained by the normative and legal regime of road behaviour. Instead, both motorised and non-motorised road users react pragmatically and routinely to the circumstances of the road as they find them. By walking, pedestrians widen the narrow legal sidewalk as needed; their desire lines, snaking across empty lots and verges, and the hardened earth of the sidewalk 'shoulder', make infrastructure from the bottom up. Cyclists carve out a lane in incoming traffic by sheer numbers, cycling en masse, in contraflow, along a major arterial road, in peak traffic. Cyclists and pedestrians both move along Kommetjie Road in groups, while the sidewalk is scarcely wide enough for two pedestrians to walk abreast. This complicates their use of spaces shared with each other and with motorists, yet produces benefits in terms of perceived safety from crime and injury. Statistics from within and beyond the Corridor suggest that motorists in South Africa are highly prone to speeding, driving under the influence, and causing death and injury to themselves and other road user groups at . Yet they also behave illegally in countless ways that are noted by cyclists and walkers as an habitual fact of the roadway, to be internalised as a condition of moving safely and predictably through the Corridor. Examples in the previous chapter include driving straight on in obligatory turning lanes, failing to stop or even slow down at pedestrian crossings, and frequently failing to yield to pedestrians and cyclists when the law requires. Perhaps the most striking example of motorist behaviour was the habit, particularly but not exclusively associated with minibus taxi drivers, of mounting the sidewalk while driving in the road shoulder, as a way of bypassing congested lanes. These examples show that all road users groups participate habitually, rather than exceptionally, in what might be termed a 'pragmatic' or informal road culture.

In contrast, the defining characteristic of the basket of CEATs considered in this study is their common assumption that the built environment is a statistically reliable indicator of what road users actually do, and therefore, of how cyclists will perceive conditions on the roadway. The key finding of this study is therefore that any prospective SA-CEAT ought to include pragmatic measurement of road users' behaviour, or their propensity to behave as the relevant physical and legal infrastructure prescribe, as a counterweight to the normative road. At present, advances in mobile technology mean that the cost of some of the means of measuring these behaviours is falling rapidly, while accuracy, applicability and ease of use are rising[1]. Indexing the propensity of various road user groups to behave as prescribed by formal transport infrastrucure would, in the first instance, allow for an assessment of the cycling environment as it is lived by cyclists on the ground, rather than the form in which it was approved for construction. Incorporating informal driving, cycling and walking practices quantitatively into an SA-CEAT would serve to acknowledge their ubiquity and persistence in local road culture, and offer the potential to translate this into practice.

A second key finding of this study is that many of the most significant determinants of cycling operate on a network level, while most of the CEATs considered in this study consider every link or intersection in isolation (it is noteworthy that the two most recent CEATs, for London and Wales, include both quantitative and qualitative network-level assessments, possibly reflecting an evolution towards higher-order effects among CEATs in general). Limiting a prospective SA-CEAT to analysis at the link and intersection level would have the benefit of simplicity, flexibility and ease of use for laypersons. Indeed, the National NMT Guidelines considers network-level effects in a phase separate from that in which a CEAT might be used (see Table 2-1, page 8). However, if a prospective SA-CEAT were to fulfil an important part of its mandate and serve as a means for civil society to advocate for change, it cannot exclude network-level effects when their importance, as shown in Chapter 4, is so pronounced. To do so would dispossess activists of an important layer of analysis that could prove useful in contesting current transport planning practice and priorities. As discussed in the last section of the previous chapter, NMT planners in a relatively well-resourced metro are capable of producing plans that seem to contradict the prescriptions of the national guideline, as well as detailed and sustained critique by local transport professionals.

A prospective SA-CEAT that incorporated a measure of road users' propensity to behave as formally prescribed, as well as network-level effects based on the South African context, might well produce, in its weighting and scoring, outcomes that run counter to current prescriptions in cycling planning.

For example, such a CEAT might prioritise investments in cycling that do not resemble anything current legislation would recognise as physical 'cycling infrastructure'. This has implications for the way NMT infrastructure is currently funded, especially given the City of Cape Town's tendency, as has been discussed in Chapter 2, to aim at, and budget for, 'outputs' over 'outcomes'. For example, removing the constraints that prevent Masiphumelele's large NMT constituency from cycling and walking to key destinations in Fish Hoek and Sun Valley would be a matter of negotiations with private landlords to reclaim rights-of-way and servitudes that are currently visible in City spatial planning documents (see Figure XX) yet impassable in practice. The expenses incurred in doing might take the form of legal and administrative costs, rather than contracts to engineers and civil works contractors. Yet the effect would be to redirect NMT traffic away from the empty verges of a heavily-used arterial road and through low-volume, well-light existing streets, while also removing a large deviation from Masiphumelele commuters' lives. Between Ocean View and Fish Hoek, Kommetjie Road exemplifies 'enclave urbanism' along the section flanked by a long and unbroken electric fence on one side and a steep, bushy embankment on the other. While more lighting here may improve scores on traditional CEATs, an SA-CEAT score would potentially remain unresponsive to interventions that did not resolve the core problem stated by focus group respondents. Namely, that physical barriers, lack of lateral access and the absence of surveillance creating a haven for opportunistic crime. An SA-CEAT might be configured to recommend that, since this route has no physical alternative, it is passive surveillance that must be added (as the only intervention that will address both the risk of crime and that of injury). In practice, this could take the form of a kiosk manned by volunteers or Community Policing Forum members, or through incentives to establish small businesses that keep long opening hours, on the example of the 'lightboxes' used by the Cape Town-based Violence Prevention through Urban Upgrading project (VPUU, n.d.).

5.2 Data availability and reliability

As the fieldwork methods employed in Chapter 3 have shown, discovering network effects need not be expensive or complicated, as simple route-mapping exercises have provided the data used in this study. Yet the question of data is an important consideration for any prospective SA-CEAT. Despite various open-data initiatives, in particular those piloted by the City of Cape Town[2], obtaining local government data remains a challenge, both in terms of access and the quality and reliability of data. Basic information such as traffic volume and speed, road deaths and fatalities over time and by

1 For example, Placemeter (placemeter.com) now offers an affordable wifi-enabled, wall-mounted sensor that can automatically count and differentiate various road users groups' progress across a visually-defined boundary for an indefinite period. Footage is streamed to Placemeter's servers and destroyed during analysis, in the interests of privacy - therefore no 'surveillance', in the traditional sense, takes place. A second example are the category of smartphone-based light and sound measurement apps.

2 See the CoCT Open Data Portal at https://web1.capetown.gov.za/web1/OpenDataPortal/, the Cape Town City Map Viewer at http://emap.capetown.gov.za/egisviewer/, and the Western Cape Province's Cape Farm Mapper at http://gis.elsenburg.com/apps/cfm/.

route and node, and cycling modal share are time-consuming to collate and interpret. For example, many collision reports mention only 'Kommetjie Road' (which is more than 10km long, with significant variations in width and configuration) as the site of the incident, precluding comparative analysis of different sections of this route over time. This is the case in a city that positions itself as the national leader in commuter cycling, suggesting that data-gathering elsewhere in South Africa will be as challenging or more so. The rise of a national standard CEAT that enables cycling advocates within and beyond government to speak a common language may thus be contingent on the availability of easily accessible data in commonly-used formats. However, this challenge highlights the need for an SA-CEAT that can use qualitative input and data mapping from laypersons and road users themselves.

The following recommendations distill the conclusions above into specific measures set out in each of the composite CEAT criteria categories used in Table 2-3, as well as the category of Non-Physical Criteria arising from fieldwork, and shown in Table 4-11.

5.3 Recommendations for Non-Physical Factors

- Behaviour of all road user groups should be measured objectively, and weightings applied to the relevant physical infrastructure. A 'propensity to use road as prescribed' measure ought to apply broadly to infrastructure for cyclists, pedestrians and motorists, respectively. For example, where this rating is low for motorists, infrastructure to protect pedestrians on the sidewalk should be more robust. Where it is low, protection might be scaled down.

5.4 Recommendations for Physical Factors

5.4.1 Recommendations for Links

- Street lighting should be measured (lux).
- Adherence of drivers to road shoulder and following distance should be measured. If low adherence is found, National NMT Guidelines should be followed and physical separation provided.
- Rumble Strips should be considered as a benefit to cyclists.
- Measured road speeds should be used in design, not posted speeds.
- The width of the road shoulder should be indexed against features such as gradient and strength of prevailing winds.

5.4.2 Recommendations for Intersections

- Recognise that, at present, even experienced cyclists choose to dismount at major intersections. Signal timing for pedestrians should be a weighting for the intersection score. The higher it is, the lower the score for the route. Alternatively, the ratio of cycles for motorised traffic versus pedestrians should be measured. A second alternative would be to measure the average amount of time, in seconds, that cyclists and pedestrians currently wait in practice before crossing, and let this observed time inform future signal timing.

5.4.3 Recommendations for Sidewalks and Verges

- Evaluate and assess the sidewalk as part of the cycling environment, in the absence of dedicated cycling infrastructure. Recognising that there are cycling constituencies who will not use the motorised roadway except as pedestrians.
- Sidewalk obstructions are well-described in the PEAT. However, passive surveillance ought to be included as a specific category of criteria, with distinctions between various types of surveillance at different times (day/night, week, month).
- Verges should be penalised, weighted for length. The measure called 'presence of roadside evasion space' in Composite CEAT should be adapted for verges, such as the section along Kommetjie Road where a long electrified fence limits lateral evasion routes for pedestrians and cyclists.

5.4.4 Recommendations for Networks

- Map bottlenecks, roadblocks and barriers. Calculate the deviation they cause to typical Origin-Destination pairs. Use this deviation as a negative weighting applied to significant routes in the network.

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Images

All images have been taken by the author, except where otherwise indicated; images are cited in the general reference list, with the following exceptions:

Figures 4, 11, 19, 25, 27-29, 30, 40, 44, 46, 50, 51, 53 and 54 were taken from the Cape Town City Map Viewer. Available: http://emap.capetown.gov.za/egisviewer/ [2016, October 1].

Figure 66: Overleaf: the construction of a new extension to Abington Road (Intersection ‘C’ in Figure 18) could, if the issues discussed in this dissertation are considered, offer access to Masiphumelele that is safe, rather than just direct.

Ethics Approval Form

Application for Approval of Ethics in Research (EiR) Projects
Faculty of Engineering and the Built Environment, University of Cape Town

APPLICATION FORM

Please Note:
Any person planning to undertake research in the Faculty of Engineering and the Built Environment (EBE) at the University of Cape Town is required to complete this form **before** collecting or analysing data.The objective of submitting this application *prior* to embarking on research is to ensure that the highest ethical standards in research, conducted under the auspices of the EBE Faculty, are met. Please ensure that you have read, and understood the **EBE Ethics in Research Handbook**(available from the UCT EBE, Research Ethics website) prior to completing this application form: http://www.ebe.uct.ac.za/usr/ebe/research/ethics.pdf

APPLICANT'S DETAILS		
Name of principal researcher, student or external applicant		Brett John Matthew Petzer
Department		Urban and Regional Planning
Preferred email address of applicant:		brett.petzer@gmail.com
If a Student	Your Degree: e.g., MSc, PhD, etc.,	Master of City and Regional Planning
	Name of Supervisor (if supervised):	Nancy Odendaal
If this is a researchcontract, indicate the source of funding/sponsorship		Click here to enter text.
Project Title		A contextual analysis of cycling environment assessment tools in a Cape Town mobility corridor

I hereby undertake to carry out my research in such a way that:

- there is no apparent legal objection to the nature or the method of research; and
- the research will not compromise staff or students or the other responsibilities of the University;
- the stated objective will be achieved, and the findings will have a high degree of validity;
- limitations and alternative interpretations will be considered;
- the findings could be subject to peer review and publicly available; and
- I will comply with the conventions of copyright and avoid any practice that would constitute plagiarism.

SIGNED BY	Full name	Signature	Date
Principal Researcher/ Student/External applicant	Brett John Matthew Petzer	Signed	**27 October 2016**

APPLICATION APPROVED BY	Full name	Signature	Date
Supervisor (where applicable)	Nancy Odendaal	Signed	Click here to enter a date.
HOD (or delegated nominee) Final authority for all applicants who have answered NO to all questions in Section1; and for all Undergraduateresearch (Including Honours).	Click here to enter text.		Click here to enter a date.
Chair : Faculty EIR Committee For applicants other than undergraduate students who have answered YES to any of the above questions.	Click here to enter text.		Click here to enter a date.